A330
TECHNICAL TRAINING MANUAL
MECHANICAL & AVIONICS COURSE - T1+T2 (LVL 2&3)
(RR Trent 700)
HYDRAULIC POWER

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HYDRAULIC POWER

Hydraulic System Line Maintenance Briefing (2) 2
Circuit Identification and Routing (2) 44
Filling Presentation (2) 50
Pressurization Presentation (2) 60
Green Hydraulic System D/O (3) 66
Blue Hydraulic System D/O (3) 100
Yellow Hydraulic System D/O (3) 128
Seal Drain D/O (3) 152
Leak Test D/O (3) 156

MAINTENANCE PRACTICE

RAM Air Turbine MAN Deployment SYS Line MAINT (2) 172

G9409341 - GAUT0T0

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW

GENERAL

There are three independent hydraulic systems: Green, Blue and Yellow. In normal operation, they are powered by Engine-Driven Pumps (EDPs) at a nominal pressure of 3.000 psi. The hydraulic supply to the EDPs can be shut off in case of emergency by means of the Fire Shut-Off Valves (FSOVs). Auxiliary power is supplied by electric pumps. A Ram Air Turbine (RAT) is included in the green system for emergencies. The Hydraulic System Monitoring Unit (HSMU) is used to monitor each hydraulic system, records failures, gives automatic control of the RAT extension, control of the electric pumps, and automatic closure of green FSOVs at green reservoir low level.

Each system has its own air pressurized reservoir in order to prevent pump cavitation. The fluid supply to each EDP is done via a motorized FSOV. These valves can be closed manually or automatically (FSOVs green 1 & 2) following some failures.

Each engine accessory gearbox drives two variable displacement hydraulic pumps. The pump maintains a system nominal pressure of 3000 psi. Each EDP is lubricated by the hydraulic fluid. Each system has an auxiliary electric pump. All the electric pumps can be manually started for maintenance operation on ground or anytime in flight. On the yellow system, the electric pump operates automatically during cargo door operation.

Each system has an accumulator to maintain a constant pressure during normal operation to cover transient demands. For each system, a leak measurement valve is located downstream of the pumps. They are controlled in the cockpit and isolate the flight control surfaces (on ground only).

The RAT is installed on the green system and can be manually or automatically extended following failures in flight. The RAT compartment is closed by a RAT operated door. A hand pump is installed on the yellow system and is only used for cargo door operation. Another pump is installed on the green ground service panel for reservoir filling.

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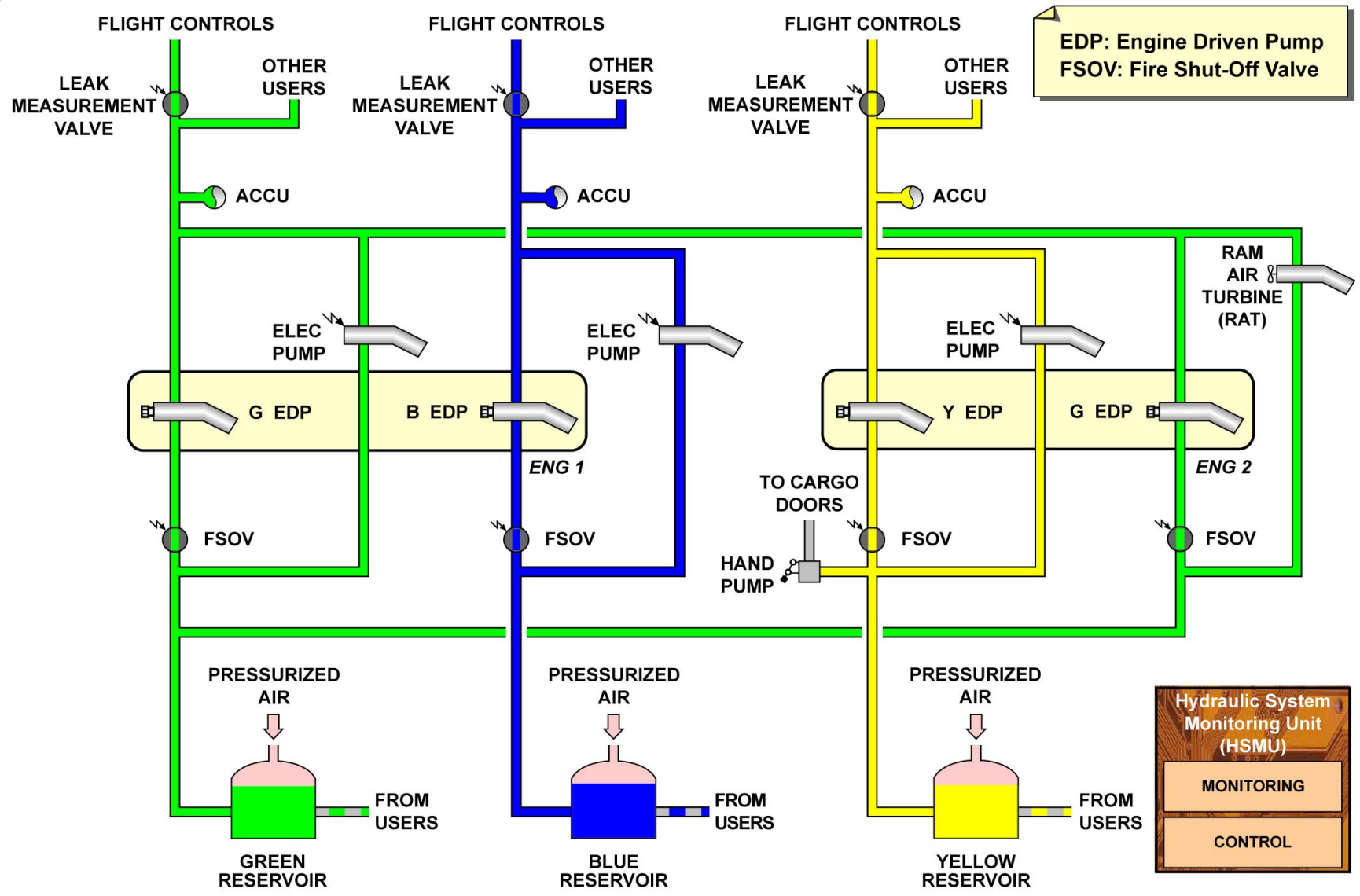

SYSTEM OVERVIEW - GENERAL

G9409341 - GAUT0T0 - FM29B1000000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

USERS

The blue system supplies the thrust reverser 1 and the yellow system supplies the thrust reverser 2 (RR and PW engines only). The flight controls supply, which is evenly divided between the three hydraulic systems, is done through the leak measurement valves. These valves can be closed for maintenance operation. The hydraulic supplied to the heavy users is taken before the leak measurement valves, and the green system includes a priority valve which cuts the supply to the L/G, nose wheel steering and emergency generator in case of green low pressure.

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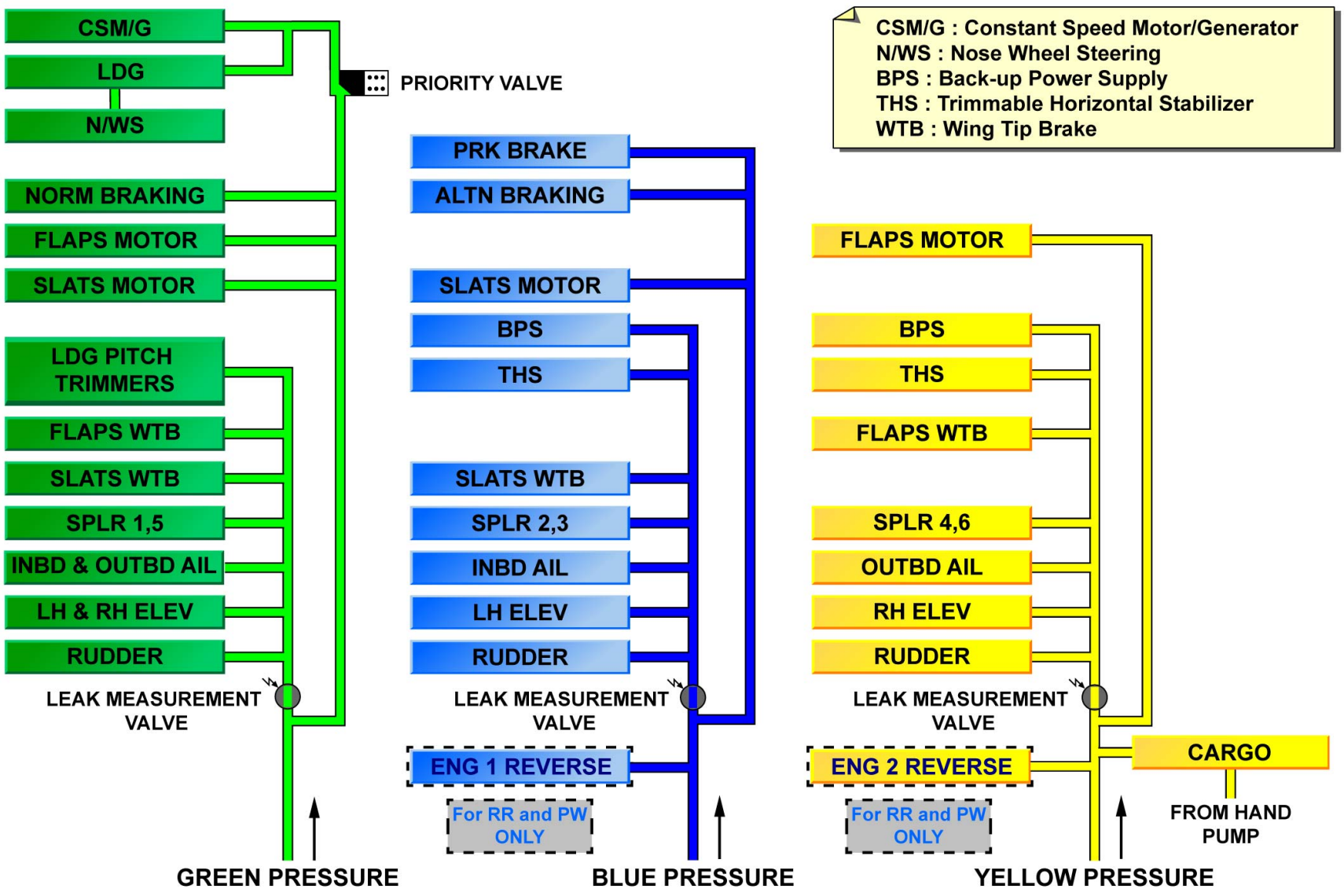

SYSTEM OVERVIEW - USERS

G9409341 - GAUT0T0 - FM29B1000000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

RESERVOIRS

The green reservoir is located inside the MLG bay, on the left section of the aft wall. The yellow reservoir is located inside the yellow hydraulic compartment, on the right forward section of the belly fairing. The blue reservoir is located inside the blue hydraulic compartment, on the left forward section of the belly fairing.

ENGINE PUMPS

The green EDPs are attached to the accessory gearbox at the bottom of the engines 1 and 2. The blue EDP is attached to the accessory gearbox at the bottom of the engine 1. The yellow EDP is attached to the accessory gearbox at the bottom of the engine 2.

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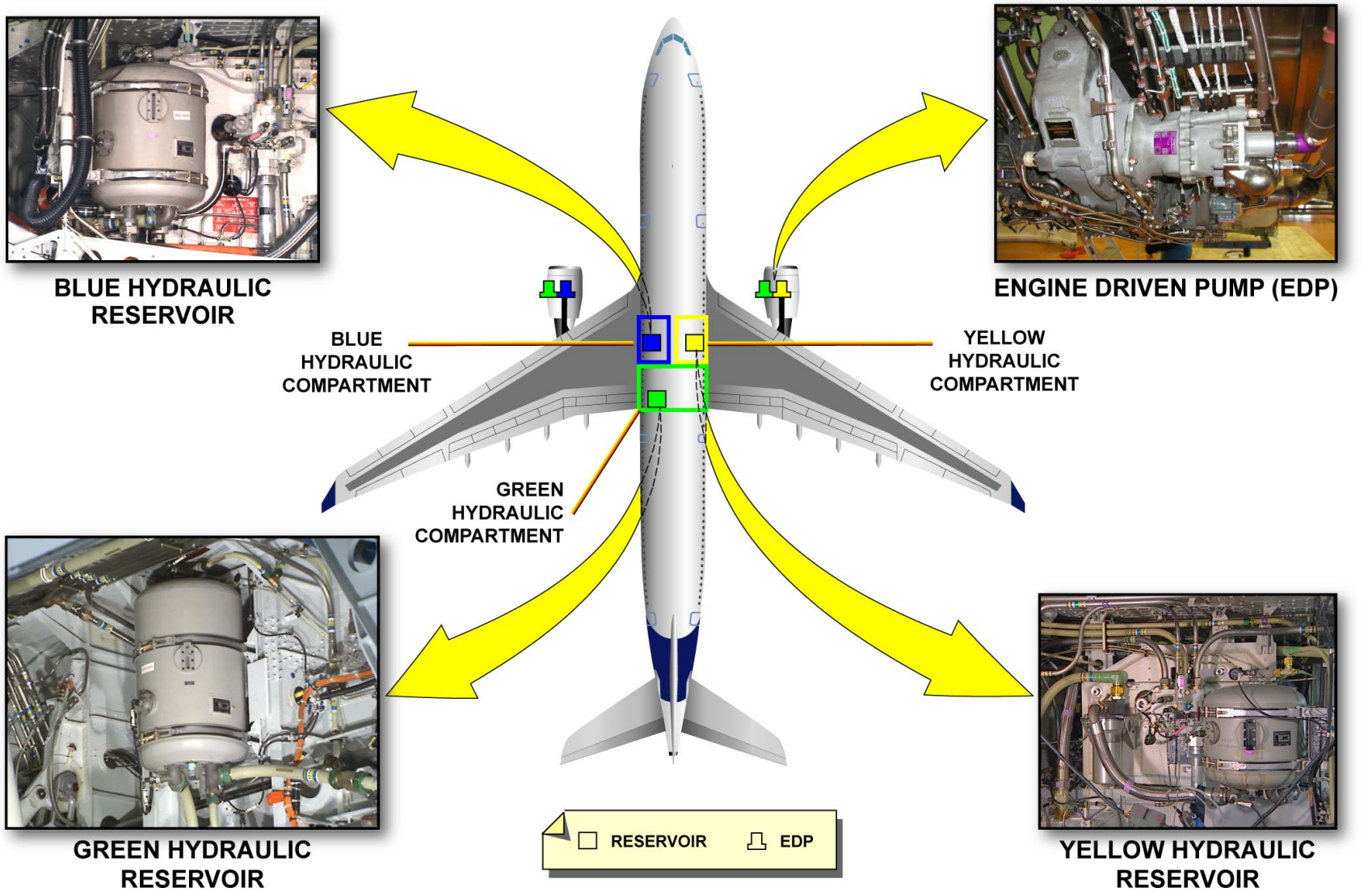

SYSTEM OVERVIEW - RESERVOIRS & ENGINE PUMPS

G9409341 - GAUT0T0 - FM29B1000000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

ELECTRICAL PUMPS

The green electrical pump is located inside the MLG bay, on the left section of the aft wall. The yellow electrical pump is located inside the yellow hydraulic compartment, on the right forward section of the belly fairing. The blue electrical pump is located inside the blue hydraulic compartment, on the left forward section of the belly fairing.

RAM AIR TURBINE

The RAT and related components (Green system) are located on the right wing in the fairing of the flap track number 4(fairing No3).

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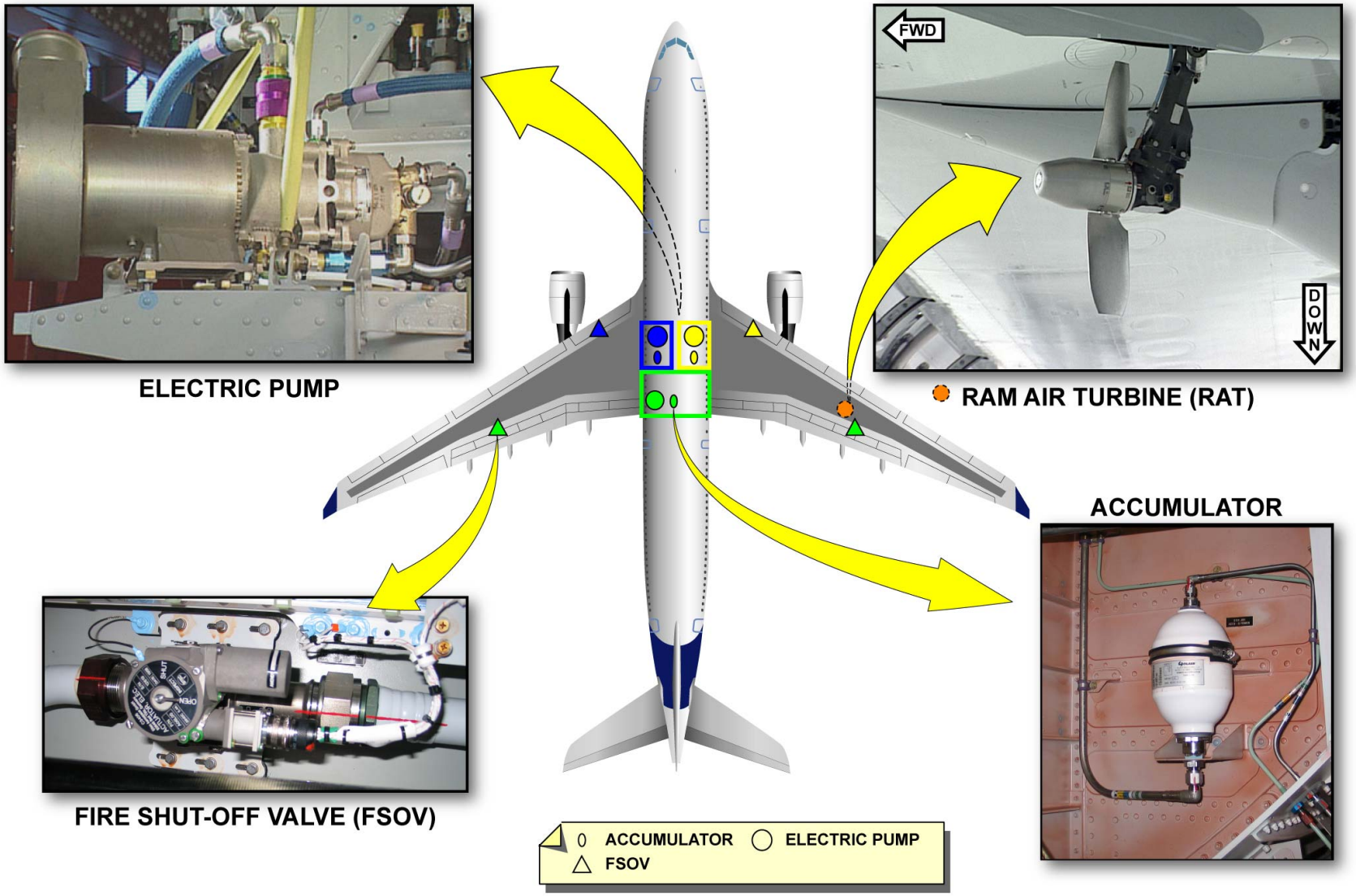

SYSTEM OVERVIEW - ELECTRICAL PUMPS & RAM AIR TURBINE

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

SERVICING PANELS

The hydraulic servicing panels are located on the belly fairing on the left aft section for the green system, left forward section for the blue system and on the right forward section for the yellow system.

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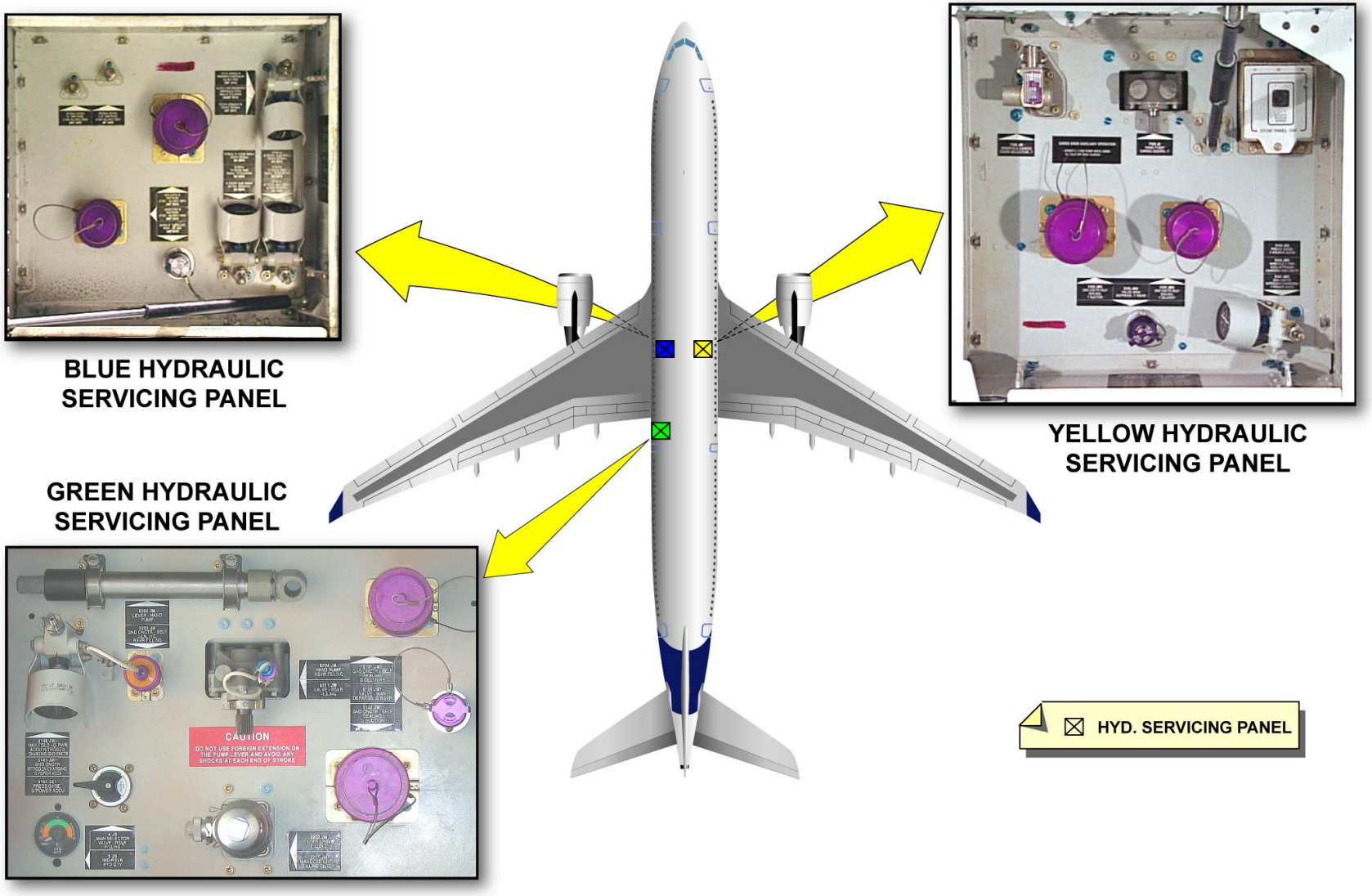

SYSTEM OVERVIEW - SERVICING PANELS

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HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

HSMU

The HSMU is located inside of the electronic compartment in the electronic rack 800VU.

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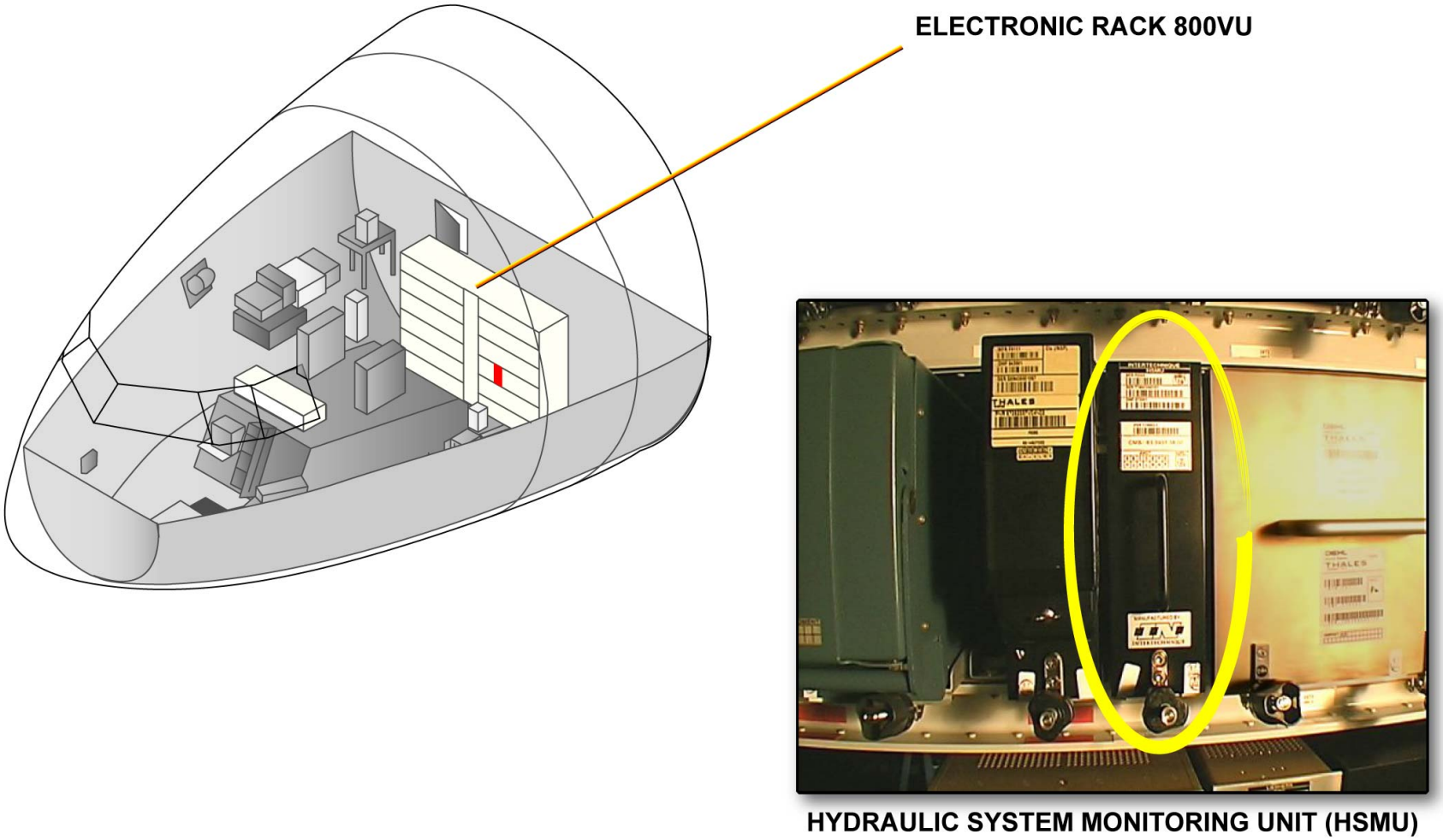

SYSTEM OVERVIEW - HSMU

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

MAINTENANCE/TEST FACILITIES

The HSMU has a BITE that tests, manages and records failures to help the maintenance operations. HSMU BITE information is sent to the MCDUs through the Central Maintenance Computer (CMC).

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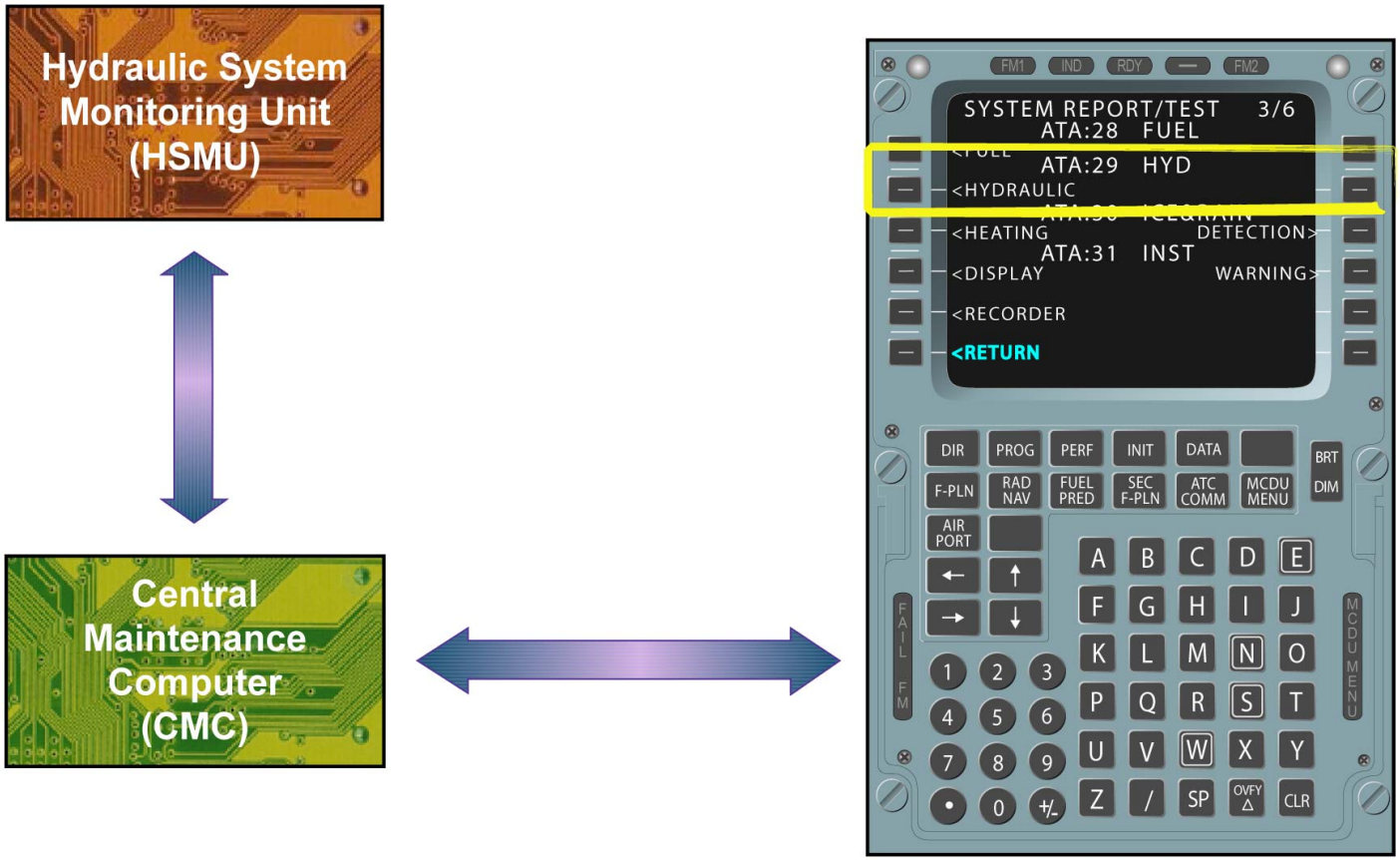

SYSTEM OVERVIEW - MAINTENANCE/TEST FACILITIES

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

SAFETY PRECAUTIONS

When you work on aircraft, make sure that you obey all the Aircraft Maintenance Manual safety procedures. This will prevent injury to persons and/or damage to the aircraft. Here is an overview of the main safety precautions relative to the hydraulic power system. Make sure that the hydraulic system in maintenance is isolated before you pressurize the other hydraulic systems. Do not get hydraulic fluid or hot gas from the hydraulic reservoir on your body. Use protective clothing to prevent risk of poisoning and burns. Use solvents, jointing compound and other special materials in a ventilated area. To prevent inadvertent breathing or contact with your body, use applicable gloves, eye protections and face mask.

During the hydraulic leak check, do not touch the hydraulic components under high pressure and do not stay near these components. Put on protective clothing to prevent inadvertent fluid injection. Do not use engine oil / chlorine solvents on the hydraulic systems. This will prevent contamination of the hydraulic fluid and damage to the components.

Do not touch the hydraulic system components until they are cool. The engine components stay hot and can burn you. Be careful during removal/installation of heavy components to prevent injury to persons and damage to equipment. Do not push the RAT MANual ON P/B for more than 1 minute this will prevent damage. During the RAT test, which can lead to RAT extension, keep all persons away from the RAT area and make sure that the RAT travel range is clear. Movement of the RAT can cause injury and/or damage.

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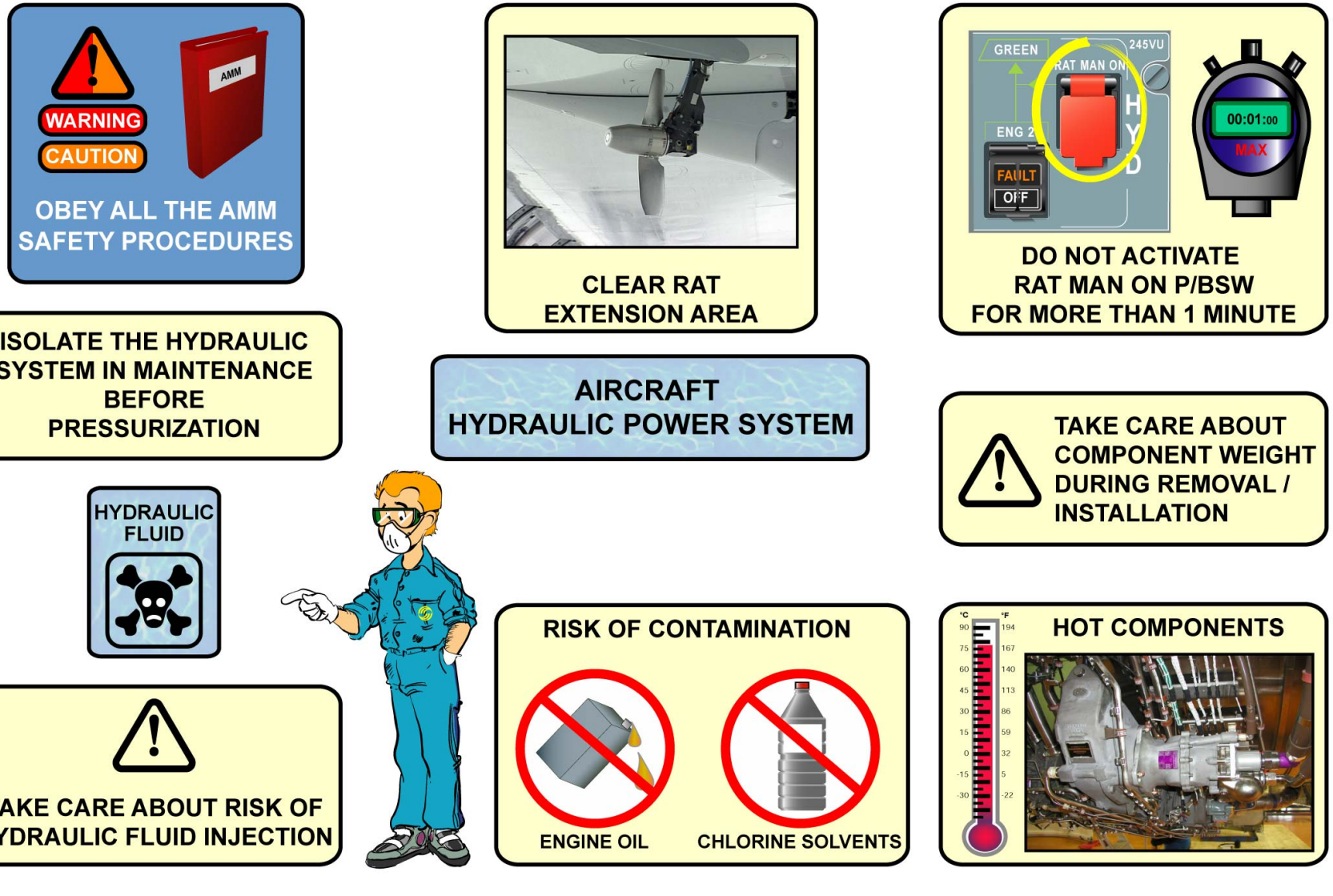

SYSTEM OVERVIEW - SAFETY PRECAUTIONS

G9409341 - GAUT0T0 - FM29B1000000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SERVICING

CHECK OF THE RESERVOIR FLUID LEVEL

As the AMM procedure is similar for all the reservoirs, the blue reservoir has been chosen as an example. Make sure the aircraft follows all the conditions:
- speed brakes and spoilers retracted,
- thrust reversers stowed,
- L/G extended with doors closed,
- reservoirs pressurized.

Confirm on the ECAM HYD page that the hydraulic systems are depressurized.

Make sure that the pressure of all pre-charged nitrogen accumulators is correctly adjusted. Pressurize the blue hydraulic system to fill the brake accumulators. Maintain electric pump operation for 1 minute after 3000 psi is achieved.

Make sure that the three reservoirs are correctly pressurized, the reading is done via the air pressure reading gauge set on the top of each reservoir.

Use the manual selector valve installed on the green ground service panel to check the reservoir levels. For each reservoir, the hydraulic reservoir quantity indicator must be on the 0 position, in the center of the green arc.

Check the reservoir content levels by using the ECAM HYD page. If no other hydraulic servicing tasks have to be done, the area can be closed. All tools, test and support used during this procedure have to be removed.

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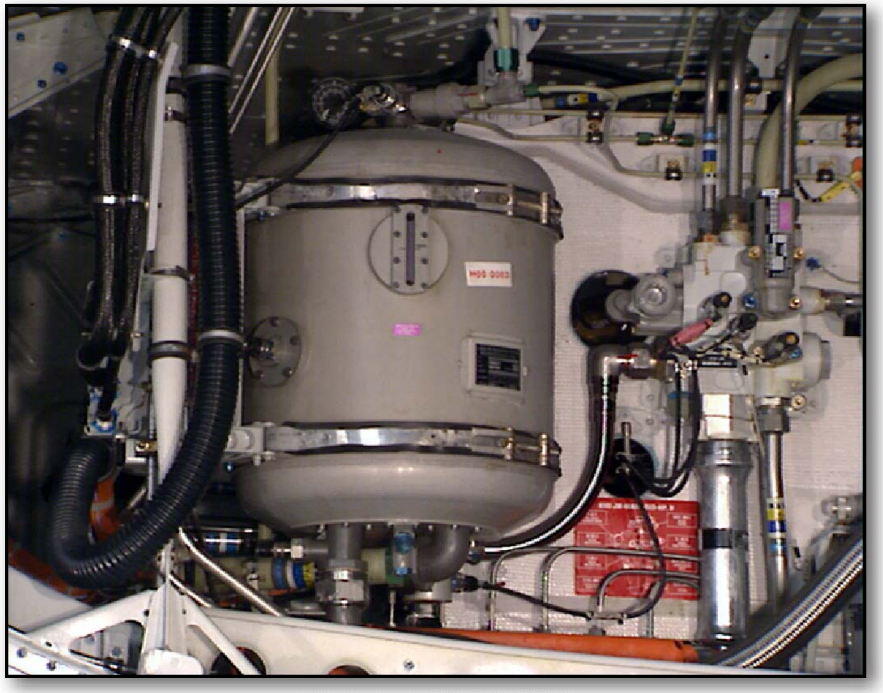
Aircraft maintenance configuration:

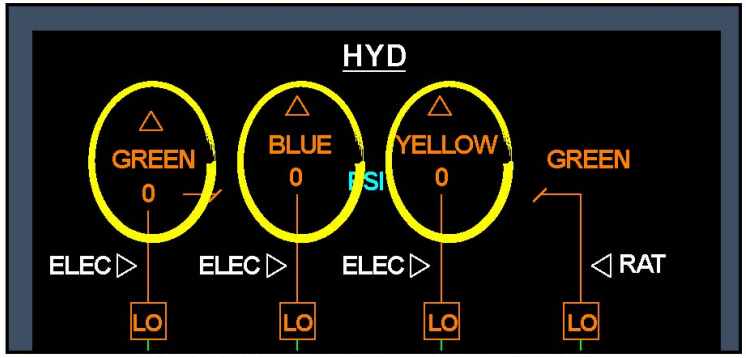
Make sure that the aircraft is in this configuration:
- the speedbrakes and the spoilers are retracted,
- the thrust reversers are stowed,
- the landing gear is extended and the landing gear doors are closed,
- all the other hydraulic services are in the normal position,
- the FWD and AFT cargo-compartment doors are closed.

Make sure that the hydraulic systems are depressurized and put them in the maintenance configuration.

Depressurized hydraulic systems.



BLUE RESERVOIR



ECAM SYSTEM DISPLAY (SD)

SERVICING - CHECK OF THE RESERVOIR FLUID LEVEL

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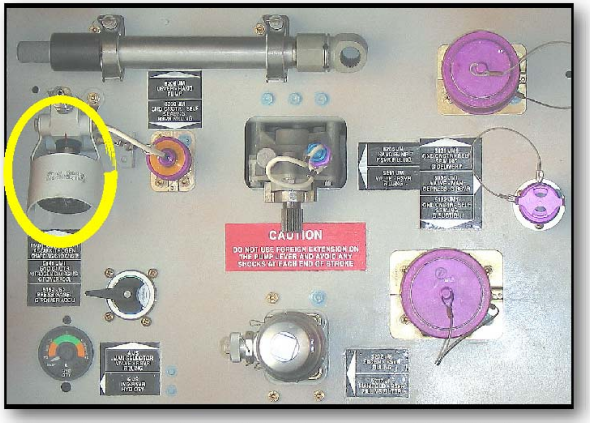
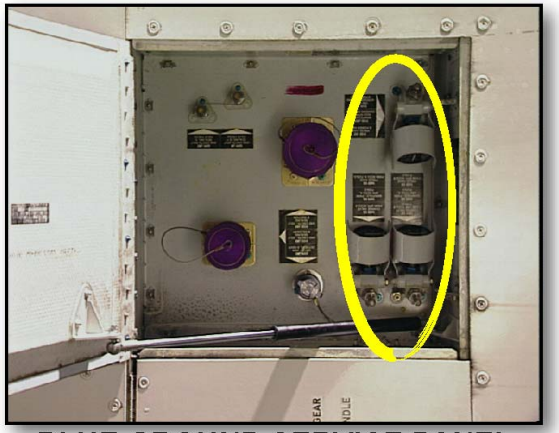
Aircraft maintenance configuration:

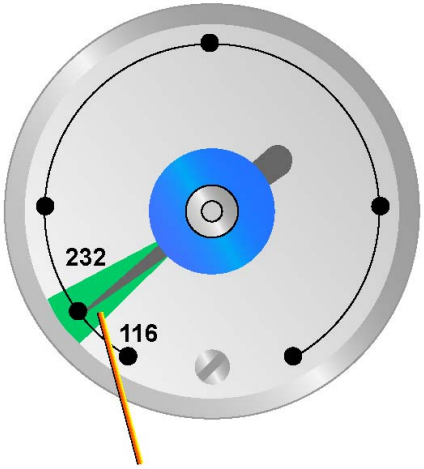
Make sure that the hydraulic systems accumulators and the brake accumulators are pressurized.



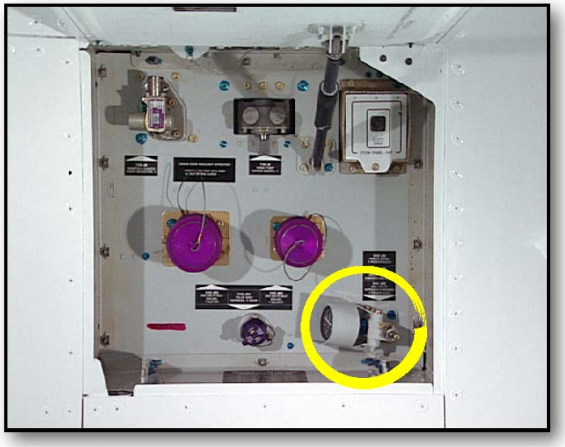
GREEN GROUND SERVICE PANEL



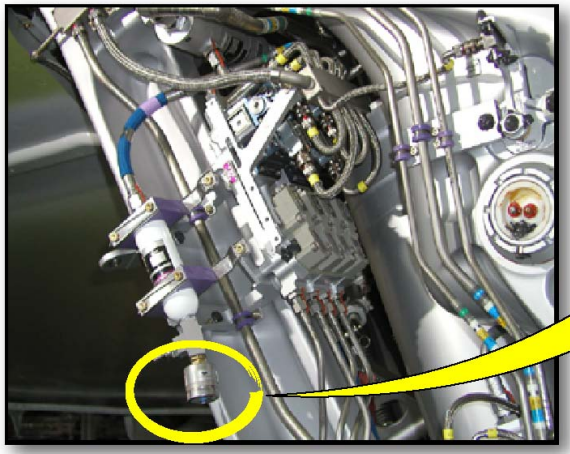
BLUE GROUND SERVICE PANEL



GREEN ZONE



YELLOW GROUND SERVICE PANEL

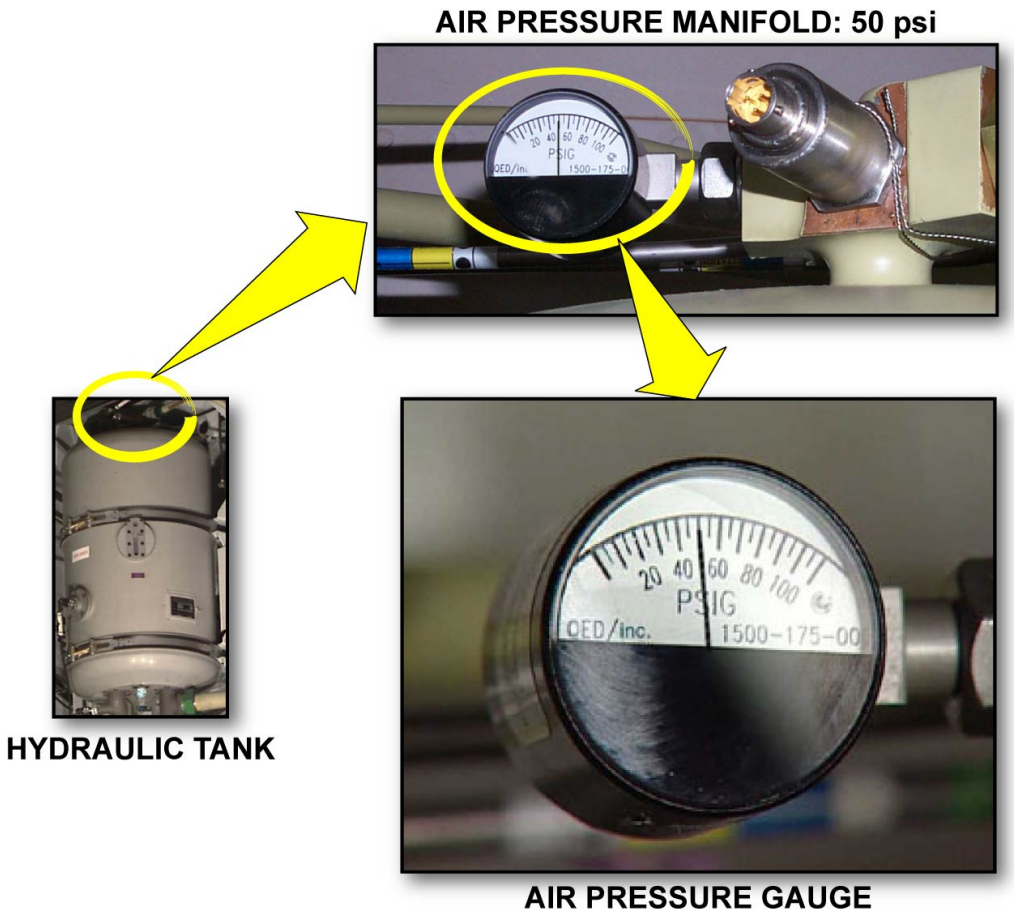


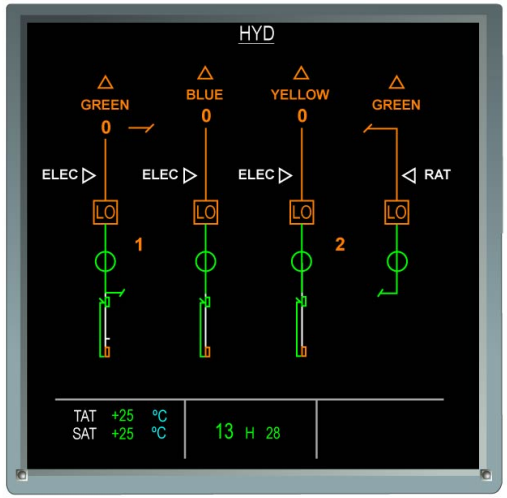
BRAKE RETURN ACCUMULATORS

SERVICING - CHECK OF THE RESERVOIR FLUID LEVEL

Aircraft maintenance configuration:

Make sure that the reservoirs of the Green,Blue and Yellow hydraulic systems are pressurized.



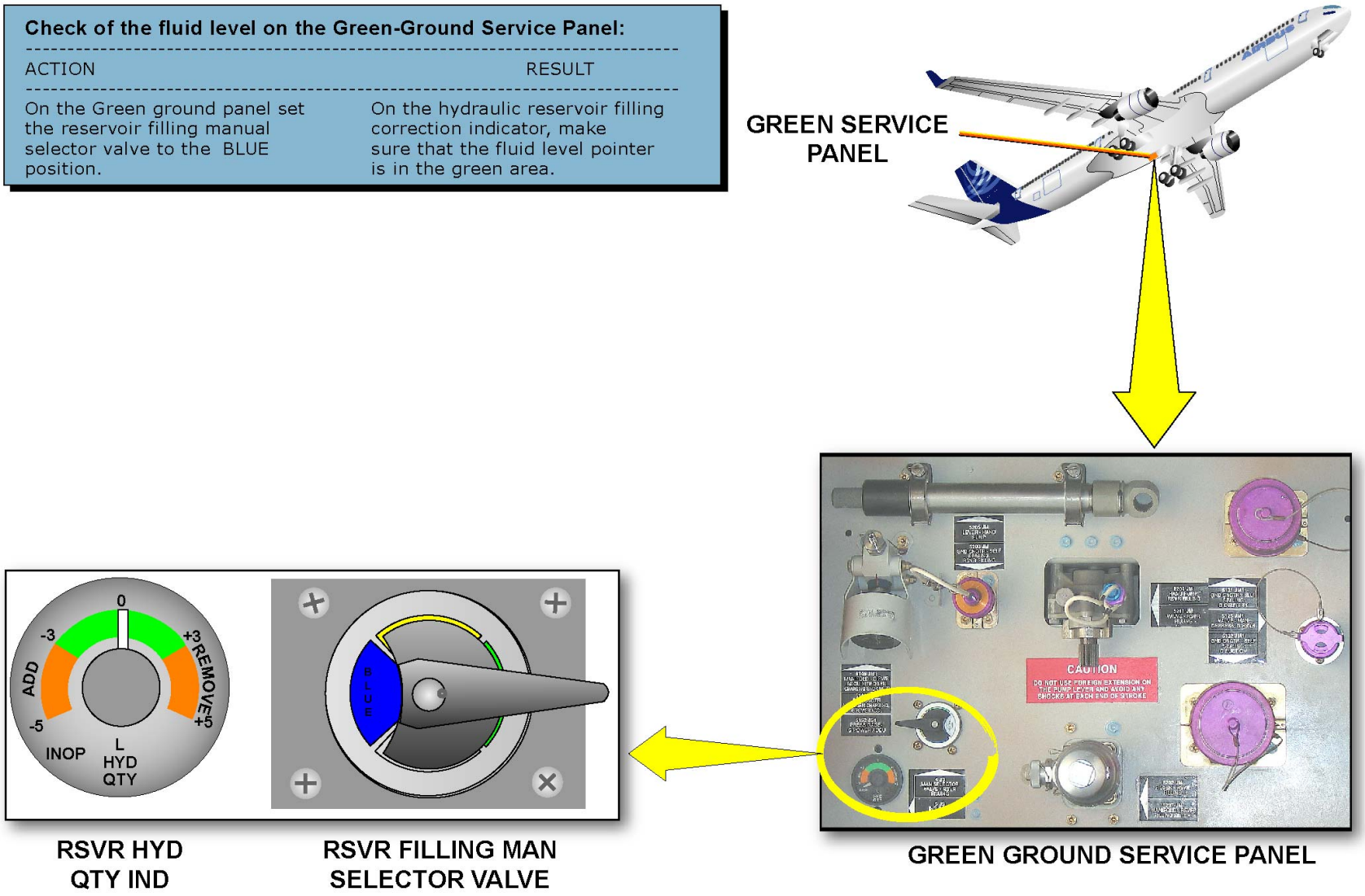


ECAM SD

SERVICING - CHECK OF THE RESERVOIR FLUID LEVEL

Check of the fluid level on the Green-Ground Service Panel:

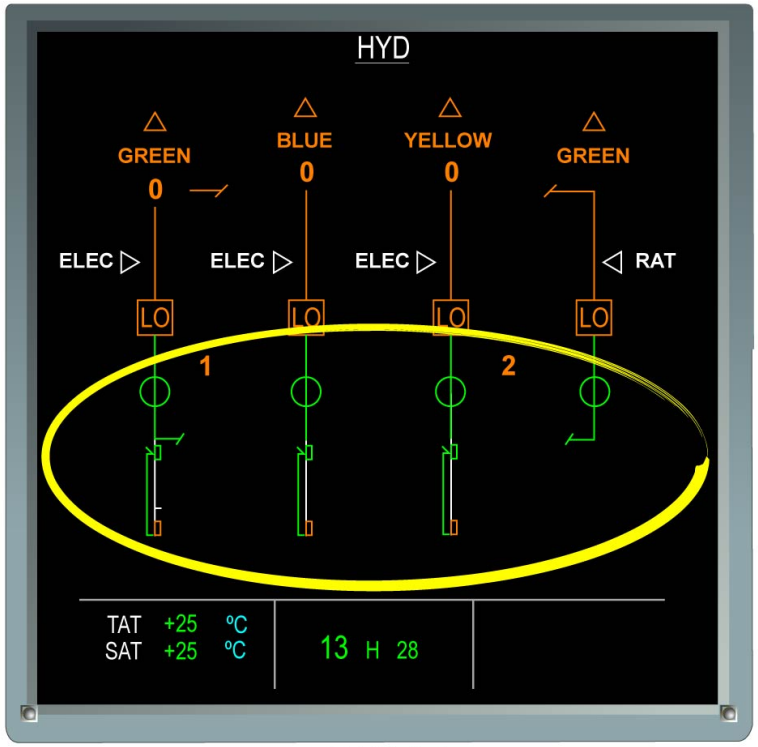
ACTION	RESULT
On the Green ground panel set the reservoir filling manual selector valve to the BLUE position.	On the hydraulic reservoir filling correction indicator, make sure that the fluid level pointer is in the green area.



SERVICING - CHECK OF THE RESERVOIR FLUID LEVEL

Check of the fluid level on the ECAM control panel

ACTION	RESULT
On the ECAM control panel,	on the SD,the HYD page appeared. On the SD: -make sure that the low level indications (in amber)are not shown for the Green, Blue and Yellow hydraulic systems. -make sure that the fluid level indexes are green.



ECAM SD

SERVICING - CHECK OF THE RESERVOIR FLUID LEVEL

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SERVICING (continued)

BLEEDING UPSTREAM OF THE ENG PUMP

Loosen the nut of the case drain hose at the engine pump until air-free fluid is obtained, then re-torque to the correct value.

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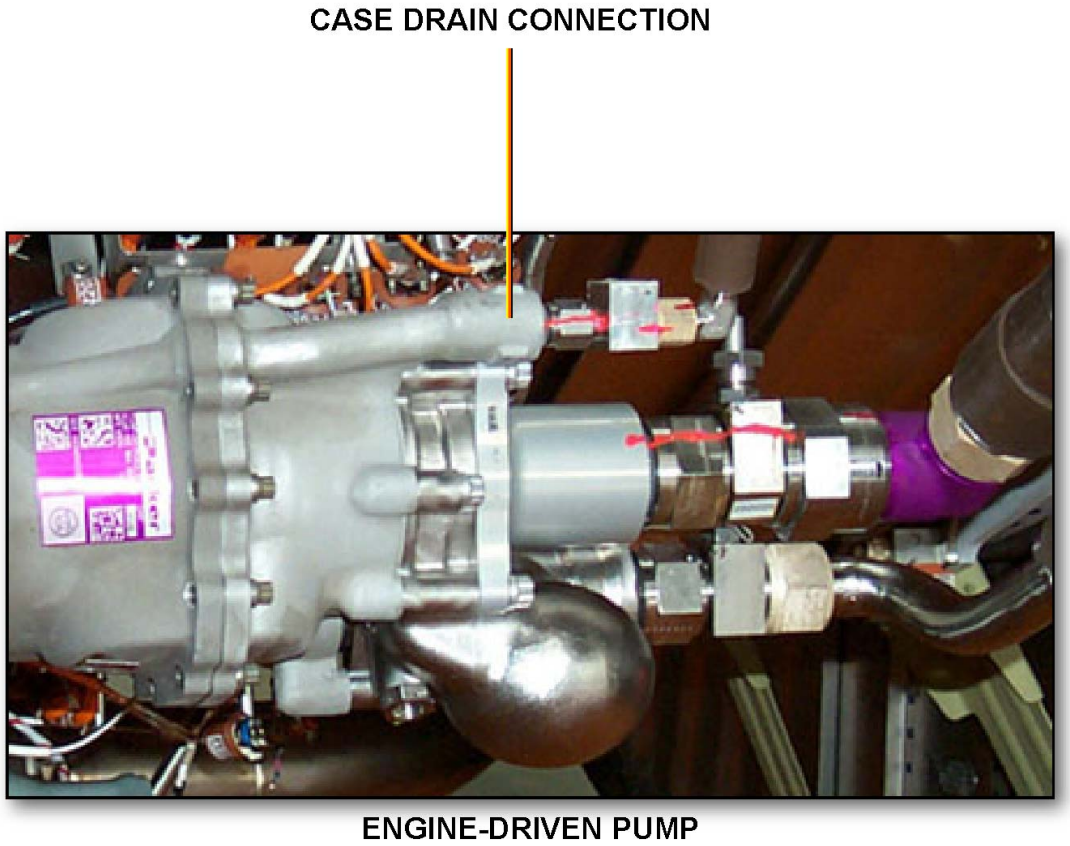
Bleeding Upstream of the Engine Pump:

Loosen the nut of the case drain hose until airfree fluid is obtained.



SERVICING - BLEEDING UPSTREAM OF THE ENG PUMP

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SERVICING (continued)

BLEEDING UPSTREAM OF THE ELECTRIC PUMP

Loosen the nut of the case drain hose at the electric pump until air-free fluid flows, then re-torque to the correct value.

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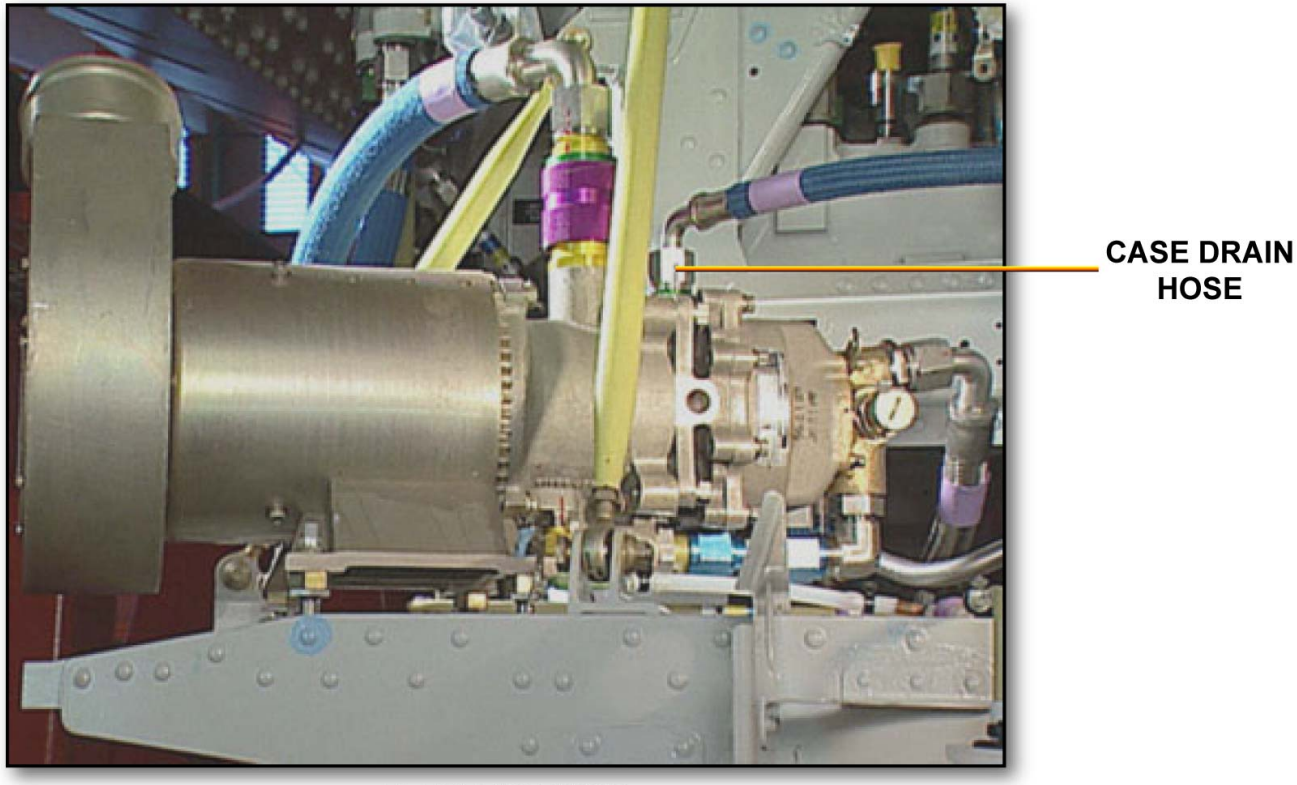
Bleeding Upstream of the Electric Pump:

Loosen the nut of the case drain hose until airfree fluid is obtained.



ELECTRIC PUMP

SERVICING - BLEEDING UPSTREAM OF THE ELECTRIC PUMP

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SERVICING (continued)

BLEEDING DOWNSTREAM OF THE ENGINE PUMP

To do the bleeding operation downstream of the engine pumps, the system is pressurized by running the related engine.
Cycling the flight controls lets air in the system be moved back into the reservoir air space.
Before stopping the engines, operate the parking brake system for the blue system.
For the green system, do an operational test of the L/G doors.
For the green system, bleed the normal brake system. For the blue system, bleed the alternate brake system.
For the yellow system, bleed the cargo door actuator system. This procedure is valid for the FWD and aft cargo door actuators.

CAUTION: Do not open the cargo door more than 90 degrees when you operate the door for the bleeding yellow system. If a large amount of trapped air is present in the actuator, the door could fall.

Open and close the cargo doors at least 10 times.

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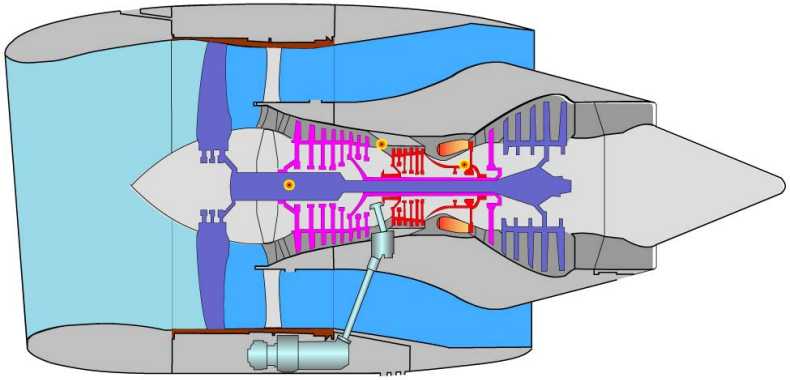
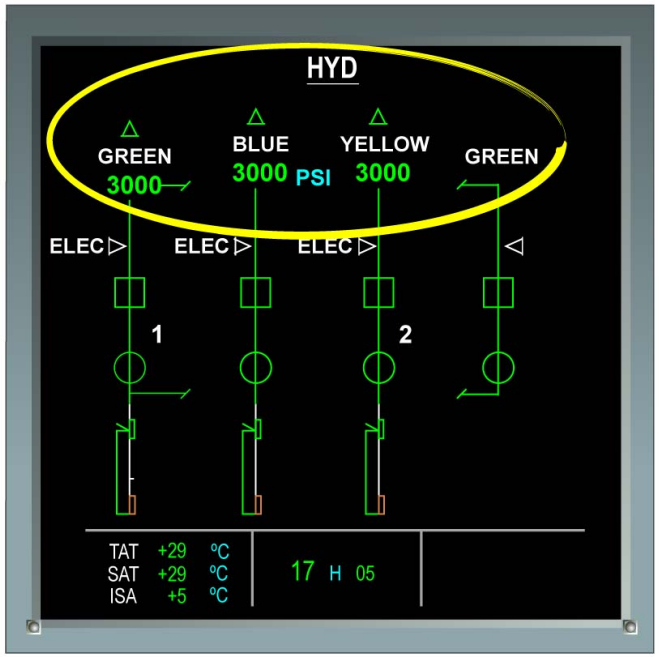
Bleeding Downstream of the Engine Pump:

Start the related engine.



ENGINES RUNNING

Pressurized hydraulic systems.



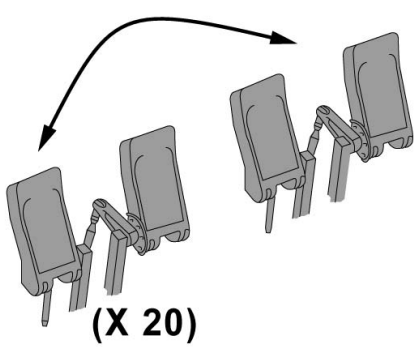
ECAM SD

SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

Bleeding Downstream of the Engine Pump:

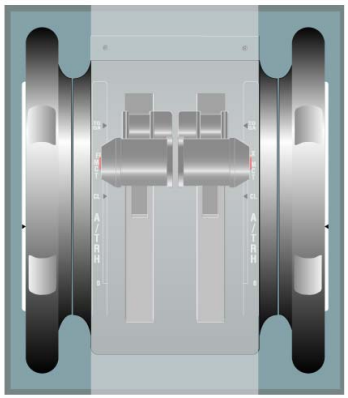
Cycling the flight controls.

CYCLED FLIGHT CONTROLS

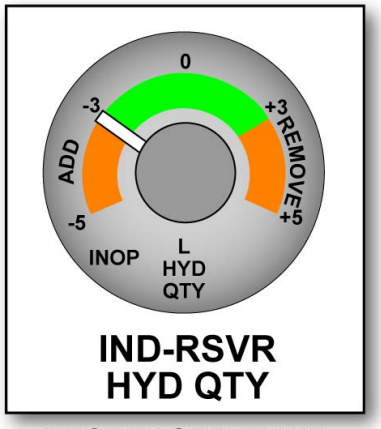


(X 20)

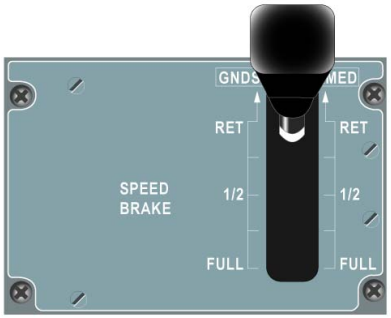
(X 20)



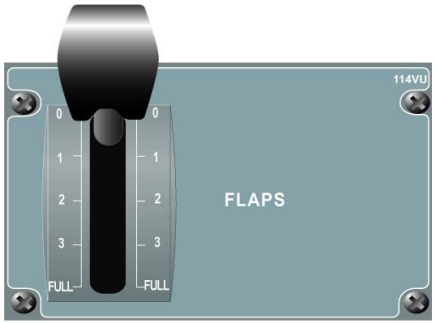
THS FULL NOSE UP TO FULL NOSE DOWN



DECREASED FLUID LEVEL



EXTENSION & RETRACTION OF THE SPOILERS

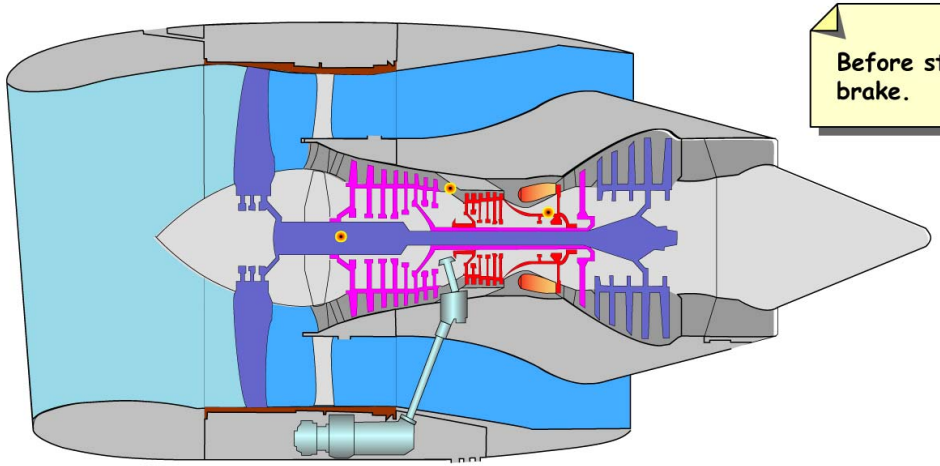


SLAT & FLAP EXTENSION (X 5)

SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

Bleeding Downstream of the Engine Pump:

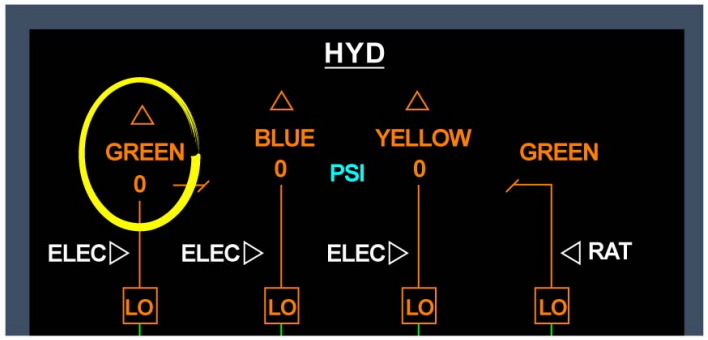
Stop the related engine (Operate also the parking brake for the blue system).



Before stopping the engines, operate the parking brake.

ENGINES STOPPED

Depressurized hydraulic systems.



ECAM SD

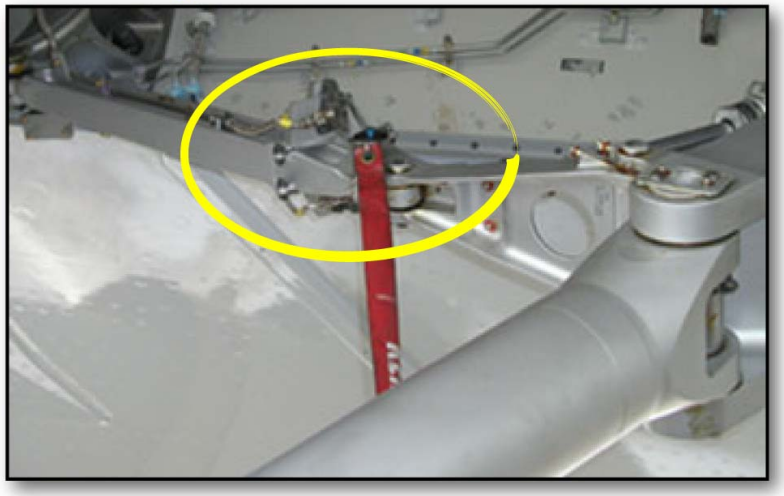
SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

Bleeding Downstream of the Engine Pump:

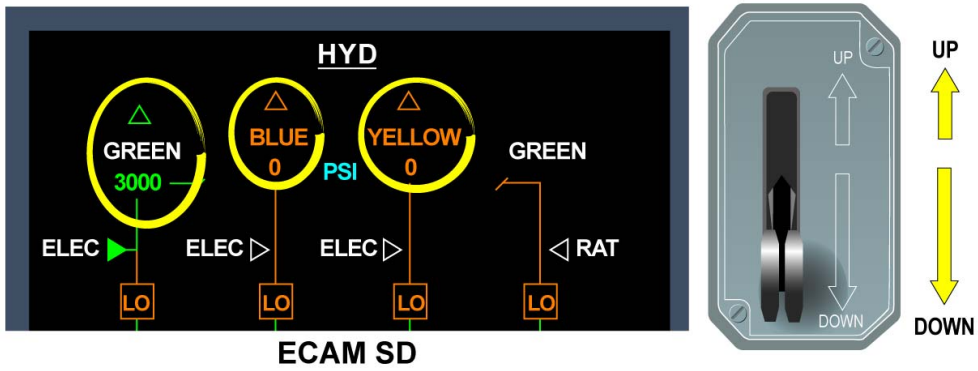
- Do an operational test of the L/G doors. Install the safety devices on the L/Gs. Then put the false targets in position.
- Make sure that the green system is pressurized and select the L/G selector 10 times.

OPERATIONAL TEST OF THE L/G DOORS

① Safety devices installed on the L/Gs



② Green hyd. pressurized + L/G selector activated (10 times)



ECAM SD

UP

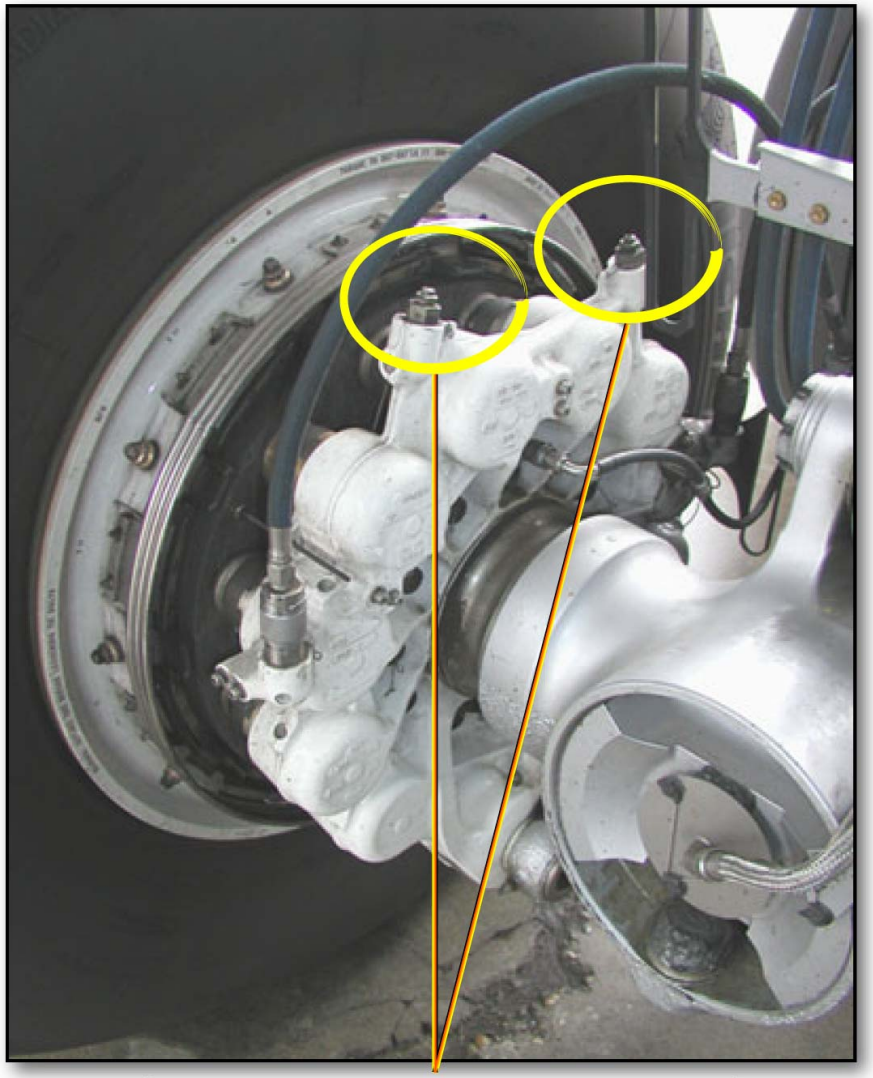
DOWN

② False targets installed to simulate flight conditions

SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

Bleeding Downstream of the Engine Pump:

- For the green system, bleed the normal brake system.
- For the blue system, bleed the alternate brake system.

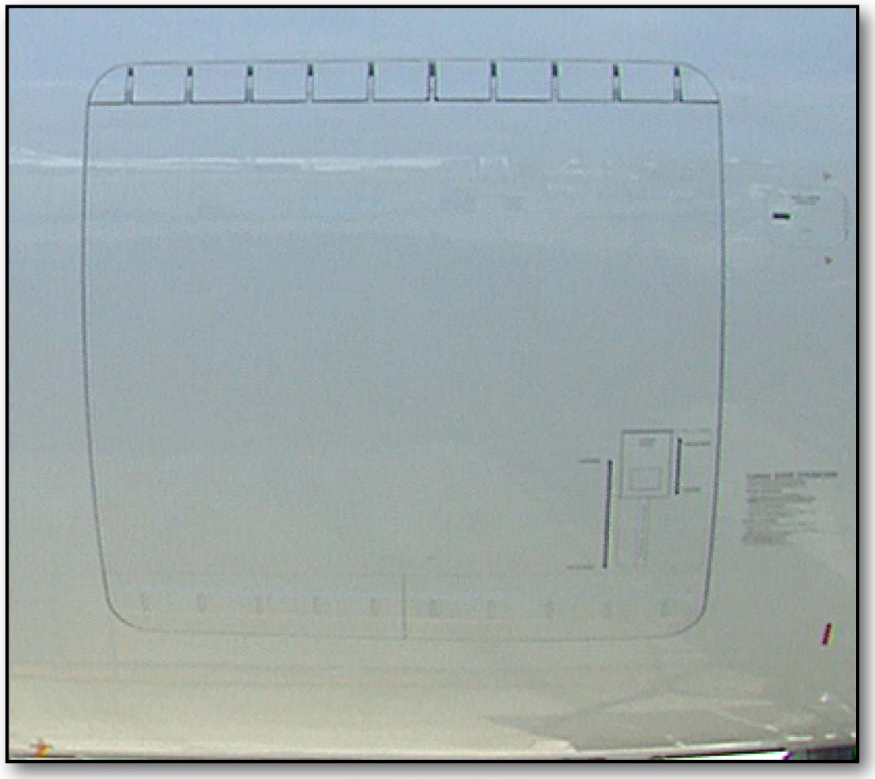


NORMAL AND ALTERNATE BLEED VALVES

SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

Bleeding Downstream of the Engine Pump:

Open and close the cargo doors at least 10 times.



CARGO DOOR

CAUTION

Do not open the cargo door more than 90 degrees when you operate the door to bleed the yellow system.

SERVICING - BLEEDING DOWNSTREAM OF THE ENGINE PUMP

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G9409341 - GAUT0T0 - FM29B100000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

SERVICING (continued)

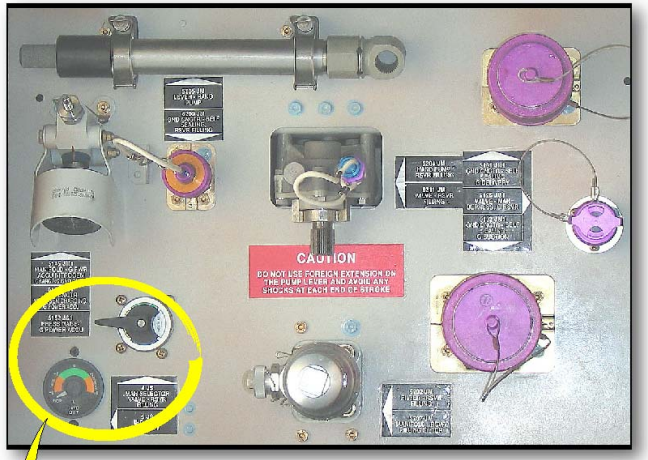
AIR SYSTEM CHECK

The green system has been chosen as example. Check and adjust if necessary the fluid level of each reservoir.
Do an air system check by recording the fluid level in both pressurized and non-pressurized conditions, using the hydraulic reservoir quantity indicator on the green ground service panel (5 minutes for stabilization between readings).
A movement of the pointer to the right shows an increase of the fluid level in the reservoir because of air expansion in the system. For the green system, if the increase is more than half of the green arc (3l), the bleeding procedure must be repeated. For the blue and yellow systems, if the increase is more than the fourth of the green arc (1.5l), the bleeding procedure must be repeated.

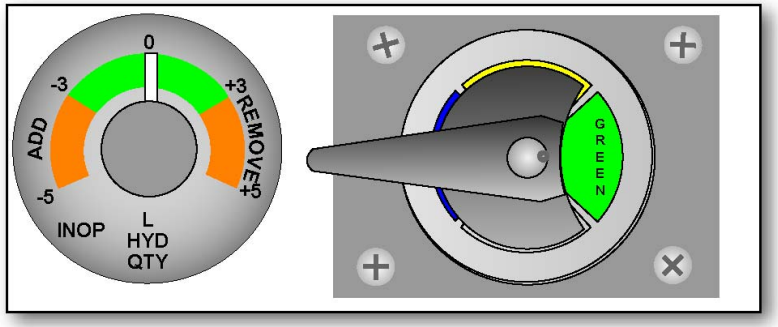
G9409341 - GAUT0T0 - FM29B1000000003

Air System Check:

Check and adjust if necessary the fluid level of each reservoir.



GREEN GROUND SERVICE PANEL



RSVR HYD QTY IND

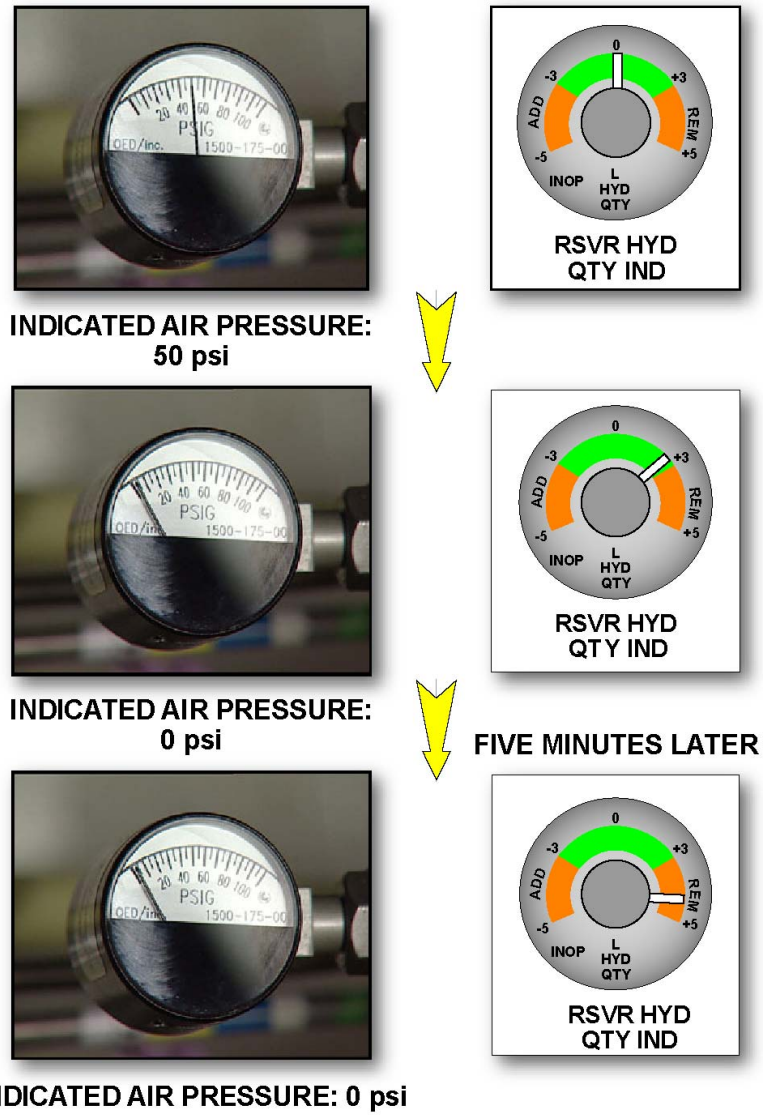
RSVR FILLING MAN SELECTOR VALVE

SERVICING - AIR SYSTEM CHECK

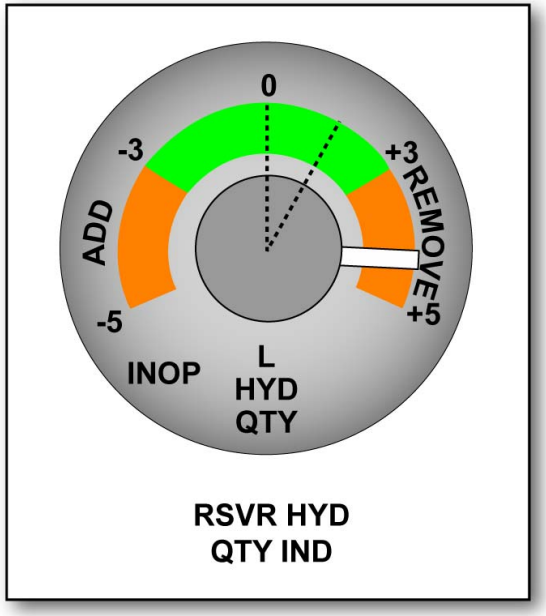
G9409341 - GAUT0T0 - FM29B1000000003

Air System Check:

Perform an air system check by recording the fluid level in both pressurized and non-pressurized conditions, using the hydraulic reservoir quantity indicator (5 min between readings).



SERVICING - AIR SYSTEM CHECK



A movement of the pointer to the right shows an increase of the fluid level in the reservoir due to the air expansion in the system.

After bleeding, if the green system increases more than half the green arc (3l), the bleeding procedure must be repeated.

After bleeding, if the blue or yellow system increases more than one of the fourth of the green arc (1.5l), the bleeding procedure must be repeated.

SERVICING - AIR SYSTEM CHECK

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

MAINTENANCE TIPS

TIGHTENING TORQUES

Before you torque a component or connection, obey the precautions and procedures given in the tightening practices for hydraulic connection procedure in the AMM Chapter 20.
The tightening torques are given in the AMM tables chapter 20.
When you use an adapter, the values shown on the dial of the torque wrench is not the applied value .To get the correct value, apply the formula given on the next picture.
The drawing shows as an example the tightening torque for HARRISSON and PERMASWAGE sleeve nuts and in-line-check valves and how to use a torque wrench and adapter.

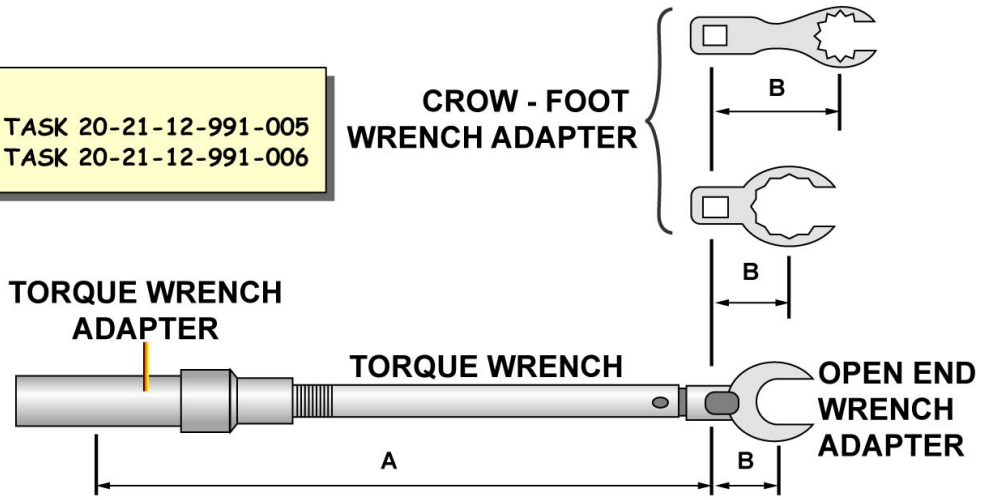
G9409341 - GAUT0T0 - FM29B1000000003

TIGHTENING TORQUES FOR HARISSON AND PERMASWAGE SLEEVE NUTS AND IN-LINE CHECK VALVES

AMM TASK 20-21-12-991-005
AMM TASK 20-21-12-991-006

ITEM CODE	OUTER DIA		TIGHTENING TORQUES Minimum And Maximum Values			
			CRES AND TI TUBES		ALLUMINIUM ALLOY	
	In	mm	m daN	lbf in.	m daN	lbf in.
3	3/16	4,76	1,1 1,2	97 106		
4	1/4	6,35	1,5 1,7	133 150	1,2 1,3	106 115
5	5/16	7,93	2,0 2,3	177 204	1,5 1,7	133 150
6	**3/8**	**9,52**	**2,9 3,2**	**257 283**	**1,8 2,0**	**159 177**
8	1/2	12,70	5,4 5,9	478 522	3,0 3,3	266 292
10	5/8	15,87	7,5 8,3	664 735	3,9 4,3	345 381
12	3/4	19,05	8,5 9,5	752 840	4,8 5,3	425 469
16	1"	25,40	8,5 9,5	752 840	8,1 8,9	717 788
20	1"1/4	31,75	8,5 9,5	752 840	9,7 10,7	859 947
24	1"1/2	38,10	8,5 9,5	752 840	9,7 10,7	859 947

If one of the constituents is made out of aluminum (Thread or nut). Apply the aluminum alloy values.



When you use a wrench adapter, you must adjust the torque values.
Use this formula to adjust the torque values:

$$T' = \frac{T \times A}{A + B} = \frac{2 \times 300}{300+100} = \frac{600}{400} = 1.5 \text{ m.daN}$$

T'= New torque values (adjusted) to be set on the torque wrench.
T= Specified torque value (applied on the connection).

Example:
Specified torque (T) = 2 m.daN (117 lb.in)
Lenght of torque wrench (A)
Without adapter = 300 mm (11.8 in.)
Lenght of adapter = 100 mm (3.9 in.)

MAINTENANCE TIPS - TIGHTENING TORQUES

G9409341 - GAUT0T0 - FM29B1000000003

HYDRAULIC SYSTEM LINE MAINTENANCE BRIEFING (2)

MAINTENANCE TIPS (continued)

EXTERNAL LEAK TEST OF COMPONENTS

A leak is the quantity of fluid that comes out of a component and that is sufficient to become a drop or drops, or will possibly become a drop of approximately 20 drops =1 cc, and 75600 drops =1 gallon.
A leakage is a quantity of fluid on the surface of a component that is not sufficient to become a drop.
A stain is an area on the surface of a component that has a different color. It is usually caused when fluid leakage becomes dry on the component surface after a high temperature operation.
For a correct analysis of component leak rates, you must obey the subsequent steps:
- the seal obtained at hydraulic tube connections is obtained on metal-to-metal surfaces. If a leak cannot be stopped by tightening the nut to the specified torque, the joint is probably defective and should be repaired,
- when possible, activate components for some cycles before carrying out the external leakage check,
- dynamic seals are easy to examine for leakage while in the static condition because pistons, slide valves and swivel joints move only during a short time interval. Many components cannot be obviously monitored during operation,
- by following the AMM procedure operate the related component,
- after operation, inspect the component. If there is a sign of any external leakage, compare the quantity of leakage with the values given in the AMM table for specified limits.

G9409341 - GAUT0T0 - FM29B1000000003

AMM TASK 29-00-00-790-801

A330 HYDRAULIC SYSTEM
EXTERNAL LEAK TEST OF COMPONENTS

EQUIPMENT	NORMAL OPERATION LIMIT	DISPATCH LIMIT TO AVOID DELAY
1 HYDRAULIC PUMP Engine Driven Pump (EDP) Electric Motor Pump Ram Air Turbine (RAT) Power Transfer Unit (PTU)		
Static seals	None	2 drops in 10 minutes
Static casing	1 drop in 10 minutes	1 drop per minute
Shaft seal (in operation)	EDP: 5 drops per min. EMP: 5 drops per min. RAT: 1 drop per min.	EDP: 60 drops per min. EMP: 30 drops per min. RAT: 1 drop per min.

MAINTENANCE TIPS - EXTERNAL LEAK TEST OF COMPONENTS

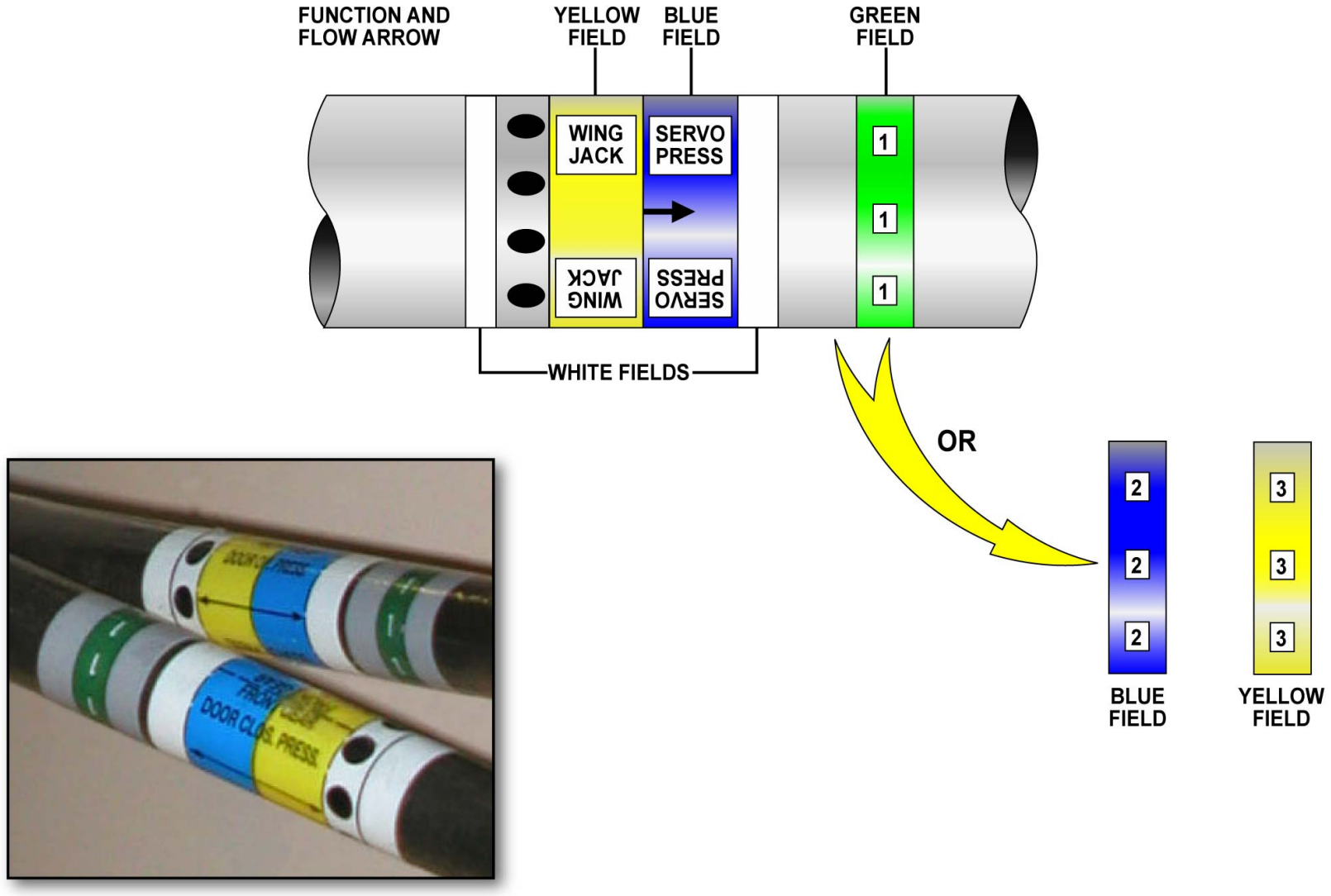
CIRCUIT IDENTIFICATION AND ROUTING (2)

PIPE ROUTING

The three systems are not hydraulically inter-connected. There are no hydraulic pipes in the passenger cabin or flight compartment.

PIPE IDENTIFICATION

Each pipe is identified by a self-adhesive label that indicates:
- its part number,
- a label identifying the pipe as an hydraulic pipe (black dots, yellow and blue fields) its function and the direction of the fluid flow, and
- a label identifying the system, comprising a color code and a number 1, 2 or 3 respectively indicating the G, B, or Y system.



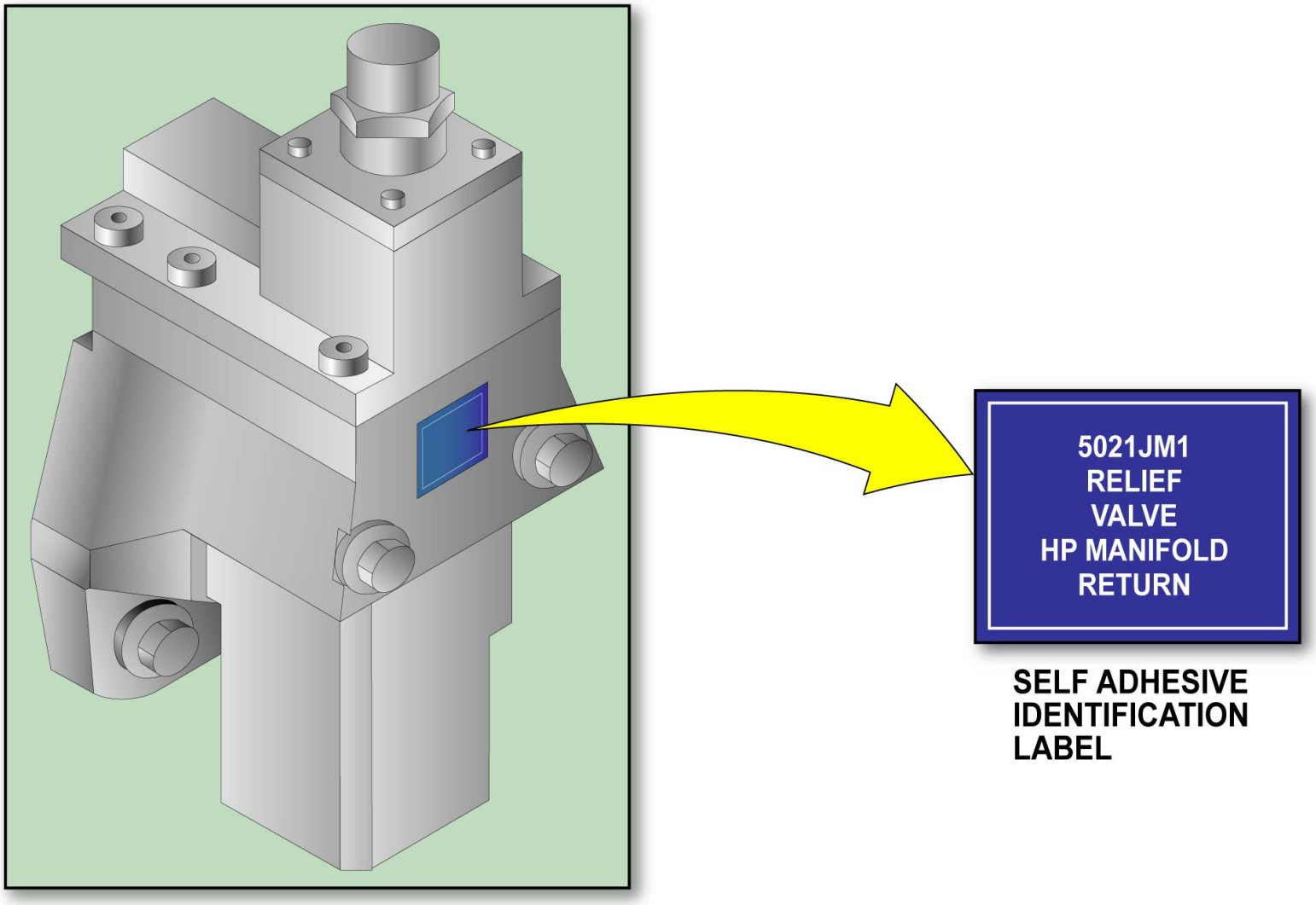
PIPE ROUTING & PIPE IDENTIFICATION

CIRCUIT IDENTIFICATION AND ROUTING (2)

COMPONENT IDENTIFICATION

Each hydraulic component is identified by a placard affixed on the structure near to it, which gives its Functional Item Number (FIN) and its designation.

G9409341 - GAUT0T0 - FM29D6F29AC0201



COMPONENT IDENTIFICATION

CIRCUIT IDENTIFICATION AND ROUTING (2)

CONNECTIONS

There are two types of connections:
- permanent connections (permaswage)
- removable connections (standard straight or special fittings).

The manifolds have bobbin type connections for some components. The bobbins have one square seal in the component side and one o-ring in the manifold side.

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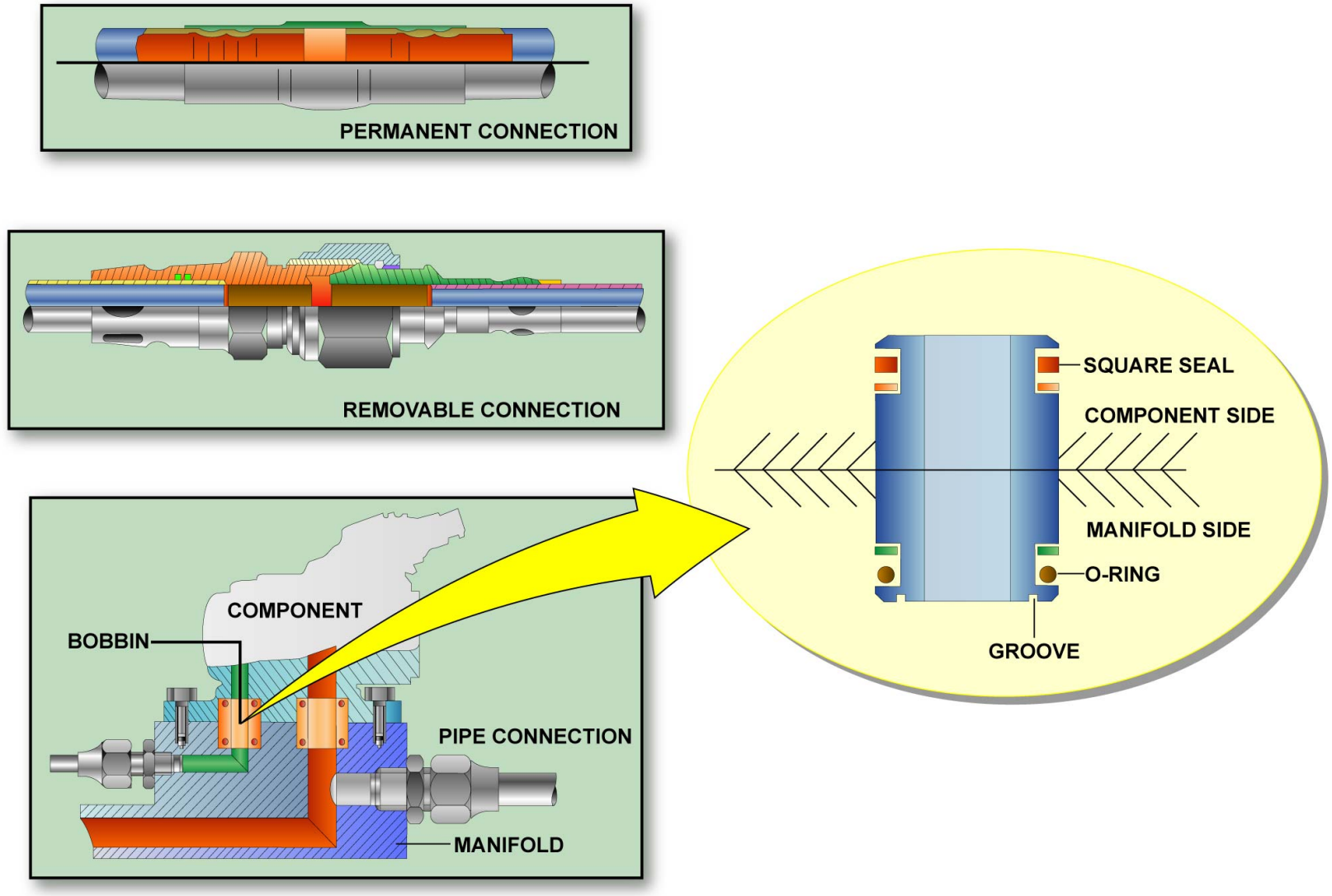

CONNECTIONS

FILLING PRESENTATION (2)

GENERAL

All three reservoirs are filled at the green ground service panel. There are two ground connectors on the service panel, one for the onboard flexible hose and the other one for connection to an external hand pump.

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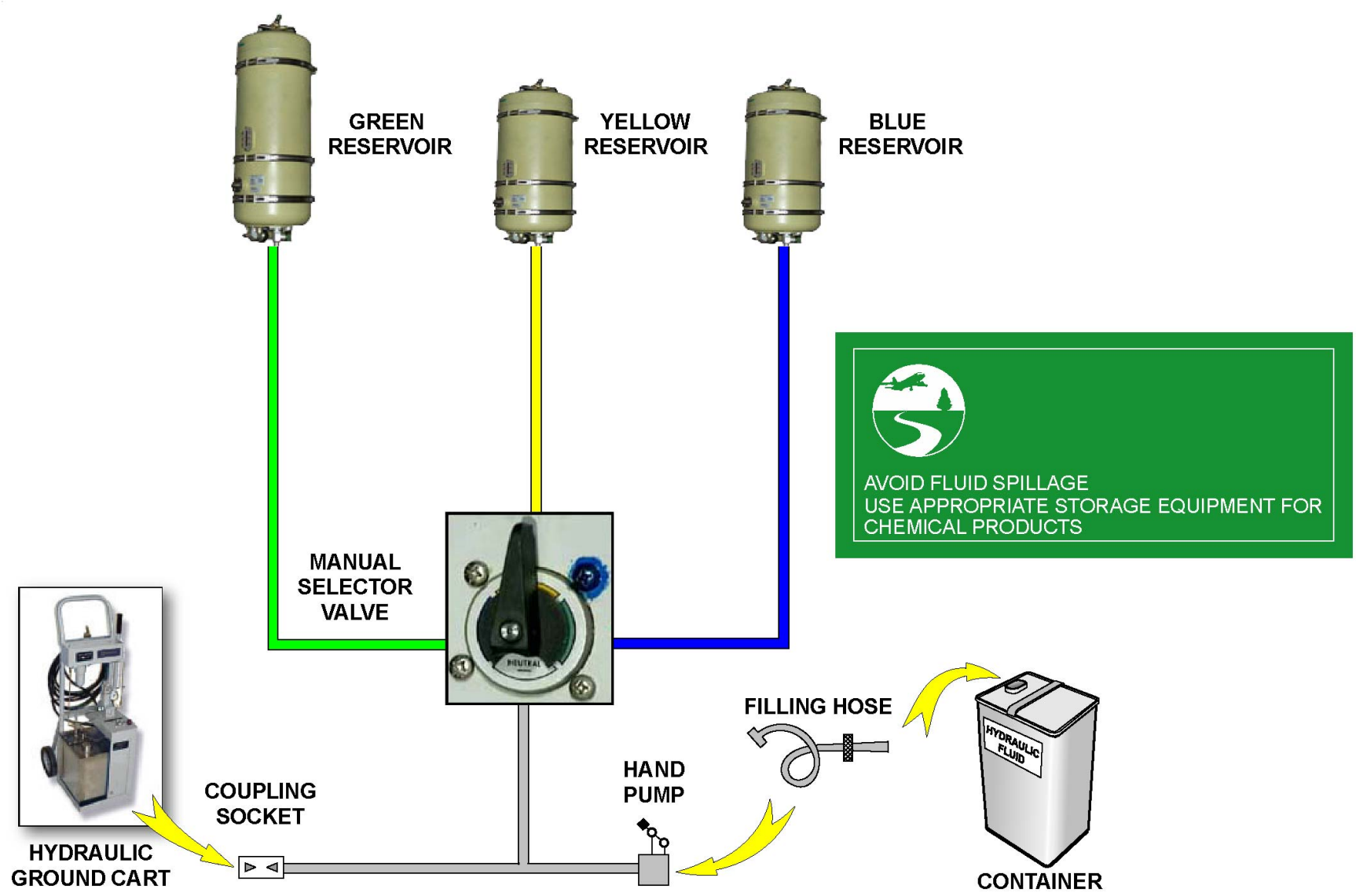

GENERAL

G9409341 - GAUT0T0 - FM29P200000002

FILLING PRESENTATION (2)

SYSTEM PRESENTATION

There are two ground connectors on the service panel, one for the onboard flexible hose and the other one for connection to an external hand pump. This line incorporates a restrictor to prevent overpressure. A filling hose is stowed at the green ground service panel. A filling valve is installed on the hand pump connection which prevents the fluid in the hose from returning in the container.
A double acting hand pump and its handle are located on the green ground service panel.
All fluids will pass through the filling filter before the manual selector valve.
This four-position valve is used to select the reservoir to be filled. It must be returned to neutral when filling is complete.
The supply to each LP manifold is made through the check valves to prevent transfer of fluid.

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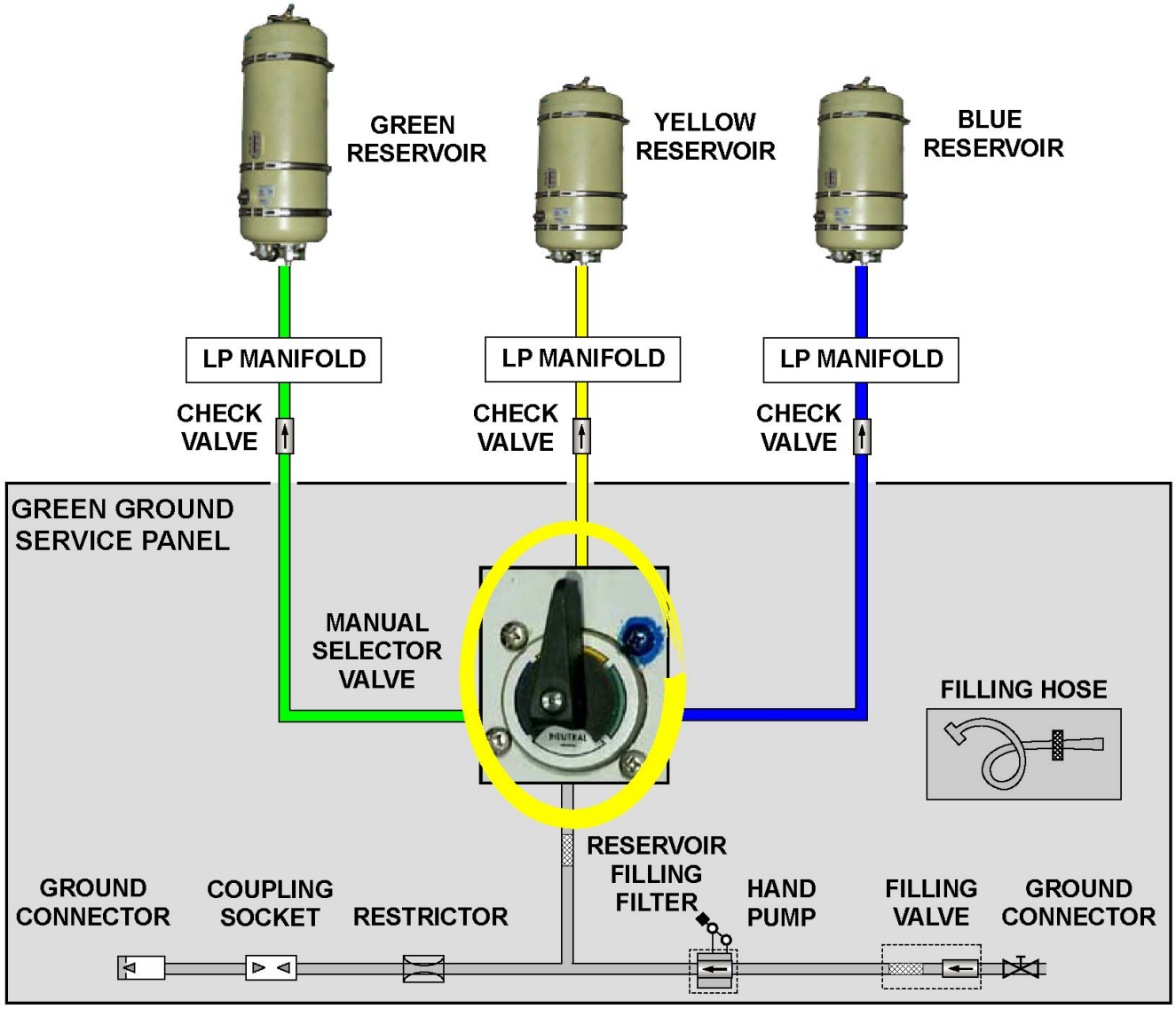

SYSTEM PRESENTATION

G9409341 - GAUT0T0 - FM29P200000002

FILLING PRESENTATION (2)

INDICATING

The quantity indicator can display low or excess fluid quantity in the selected reservoir, with temperature compensation provided by the HSMU. Filling of the reservoir can also be monitored on the ECAM HYD page. The quantity of fluid can be directly read on the sight glass located on each reservoir.

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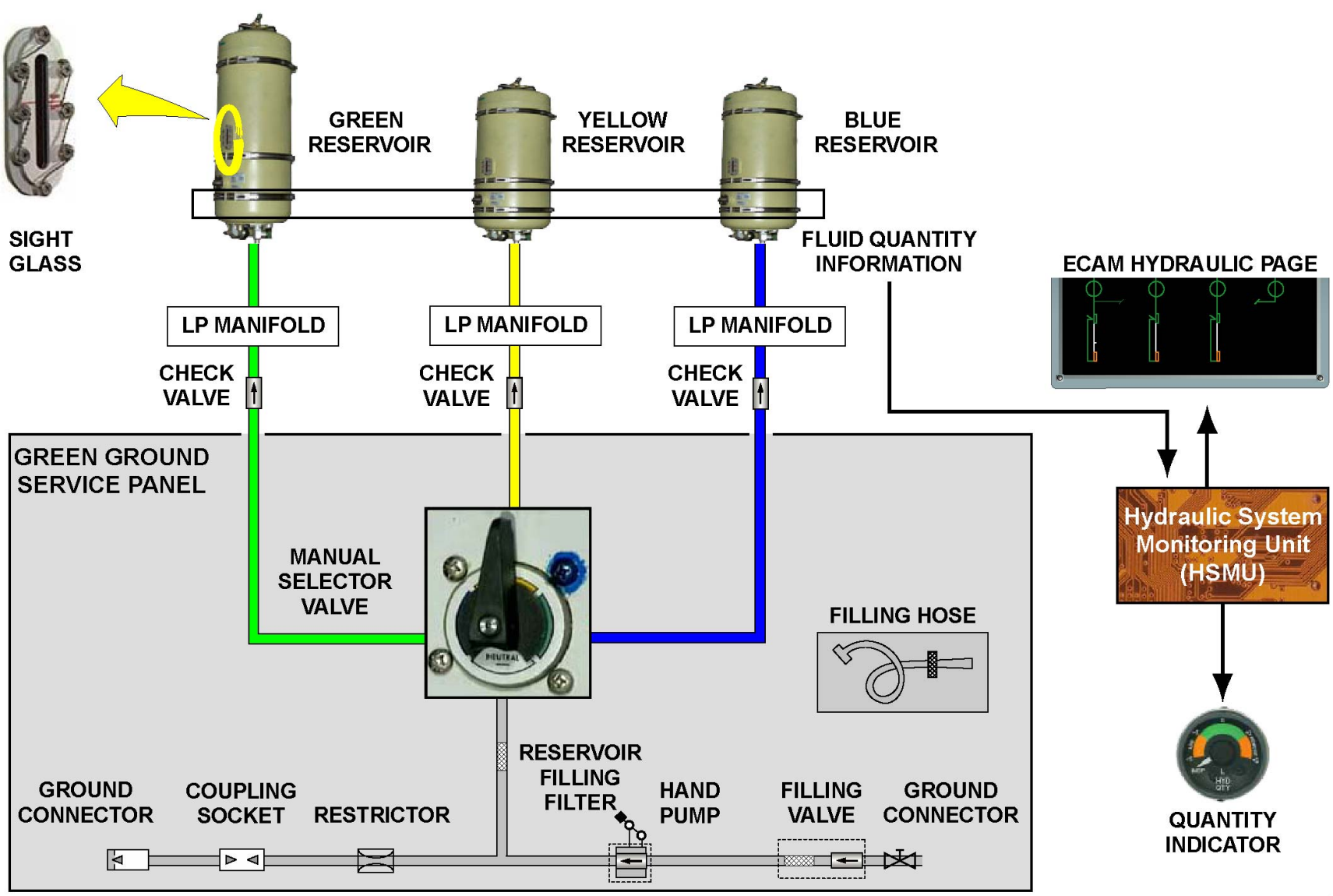


INDICATING

G9409341 - GAUT0T0 - FM29P200000002

FILLING PRESENTATION (2)

RESERVOIR FILLING VIDEO PRESENTATION

This film presents the servicing procedure to fill up the A 340 green hydraulic reservoir using either a hand pump or a hydraulic servicing cart. Note that the procedure is exactly the same for the A330.
We consider here that the aircraft electrical circuits are energized.
On the avionics compartment panel 721 VU, open, safety and tag the "Hydraulic pump green control" circuit breaker and make sure that the other related circuit breakers are closed.
Make sure that:
- the surfaces are retracted
- the thrust reversers are stowed
- the landing gear is extended and the landing gear doors are closed
- the forward and aft cargo doors are closed.

Make also sure that:
- the Green hydraulic system is depressurized
- the Green hydraulic reservoir is pressurized.
- Now let us start the filling procedure.
- Open the Green ground service panel 197CB. Make sure that the green system accumulator pressure is correct.
- Remove and connect the hand pump lever to the shaft of the reservoir filling hand pump.
- Above the panel, you find the filling hose. Remove its cap.
- Remove the blanking cap of the pump and connect the filling hose to the filling valve. The other end of the filling hose is plunged in a cleaned hydraulic fluid container.
- On the reservoir filling manual selector valve, select the green position.
- Operate the hand pump lever.
- Monitor the increase of fluid level on the reservoir hydraulic quantity indicator.
- Stop the flow when the pointer is in the centre position on the quantity indicator.

CAUTION: if some components are not in their normal position, use common sense during filling, in order to avoid under or over servicing.

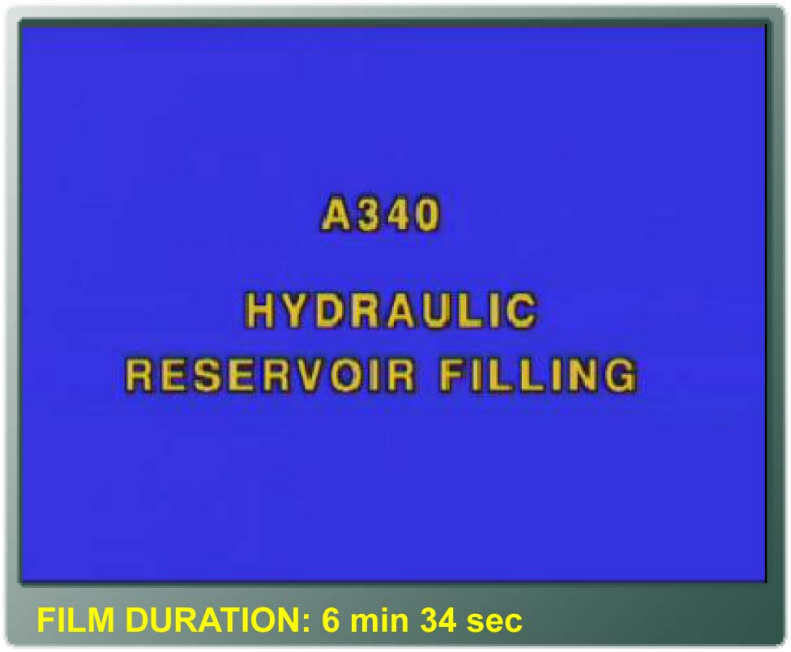
- Turn the reservoir filling manual selector valve to the NEUTRAL position.
- Remove the filling hose and install the blanking cap on the hand pump.
- Close the filling valve.
- Put the filling hose back in position on its mount.
- Remove the hand pump lever from the hand pump and put it back in position on the panel.

You can also fill the reservoir by using a hydraulic service cart.
- Remove the blanking cap from the reservoir filling self-sealing connector.
- Connect the hydraulic service cart to the reservoir filling self sealing ground connector.
- On the reservoir filling manual selector valve, select the GREEN position.
- Operate the ground hydraulic service cart.

CAUTION: Pump slowly to prevent a too high flow rate and supply pressure.

- Monitor the increase of fluid level on the reservoir hydraulic quantity indicator.
- Stop when the pointer is in the center position on the quantity indicator.
- Turn the filling manual selector valve to the neutral position.
- Disconnect the ground hydraulic service cart from the reservoir filling self-sealing ground connector and install the blanking cap.
- Once the reservoir has been filled either through the hydraulic service cart or through the hand pump, the close up tasks must be carried out.
- Close the green ground service panel 197CB.
- On the ECAM system display, verify the quantity of fluid in the green hydraulic system.
- Close the relevant circuit breaker and put the aircraft back into service.

G9409341 - GAUT0T0 - FM29P200000002



RESERVOIR FILLING VIDEO PRESENTATION

FILLING PRESENTATION (2)

ENVIRONMENTAL PRECAUTIONS

Do not discharge products such as oil, fuel, solvent, lubricant either in trash bins, soil or into the water network (drains, gutters, rain water, waste water, etc...).
Sort waste fluids and use specific waste disposal containers.
Each product must be stored in an appropriate and specific cabinet or room such as a fire-resistant and sealed cupboard.

G9409341 - GAUT0T0 - FM29P200000002

STORE PRODUCTS IN APPROPRIATE CONTAINER/CUPBOARD/ROOM

SORT WASTE FLUIDS IN CONTAINERS

AVOID FLUID SPILLAGE
USE APPROPRIATE STORAGE EQUIPMENT FOR CHEMICAL PRODUCTS

FLUID SPILL CLEANUP KIT

USE SPECIFIC WASTE DISPOSAL CONTAINERS

ENVIRONMENTAL PRECAUTIONS

PRESSURIZATION PRESENTATION (2)

GENERAL

Each reservoir is pressurized by air regulated to 50 psi to prevent cavitation of the pumps. An air pressure gage, installed on each reservoir, gives the relative pressure in the reservoir.

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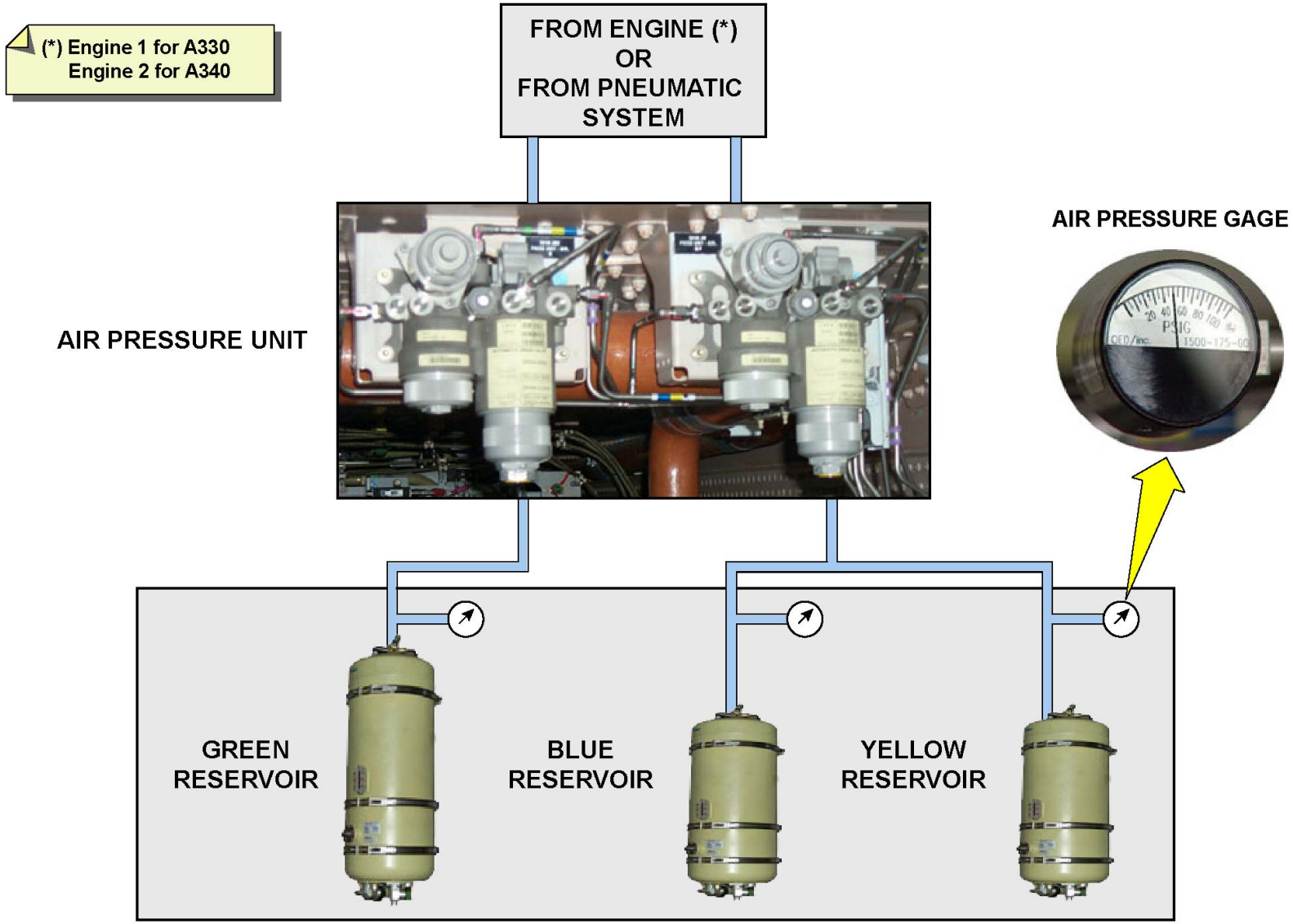


GENERAL

G9409341 - GAUT0T0 - FM29P300000002

PRESSURIZATION PRESENTATION (2)

SOURCES

The normal pressurization source is from engine 1 for A330 or engine 2 for A340 but air can also be taken from the pneumatic system. Ground connections for pressurization are also on the blue service panel. The supply from ENG 1 for A330 or ENG 2 for A340 passes through a filter and a restrictor located in the engine pylon. The restrictor limits the airflow to the pressurization unit in case of a rupture of the pressurizing line in the wing or the fuselage. The bleed air supply is taken through a manifold which includes two airflow-limiting restrictors.

AIR PRESS UNIT

There are two air pressure units, one for the green reservoir and the other for the blue and yellow reservoirs. Each air pressure unit has two check valves to prevent back flow into the pressure sources. The bleed air supply inlet has relief valves set to 75 psi. Each air pressure unit has a fluid separator with an automatic drain valve. The filter is located between the fluid separator and the pressure reducing valve. Each pressure-reducing valve reduces and regulates the air pressure to 50 psi. A depressurizing valve relieves the air pressure inside the unit to enable the automatic drain valve to operate.

RESERVOIR CHECK VALVES

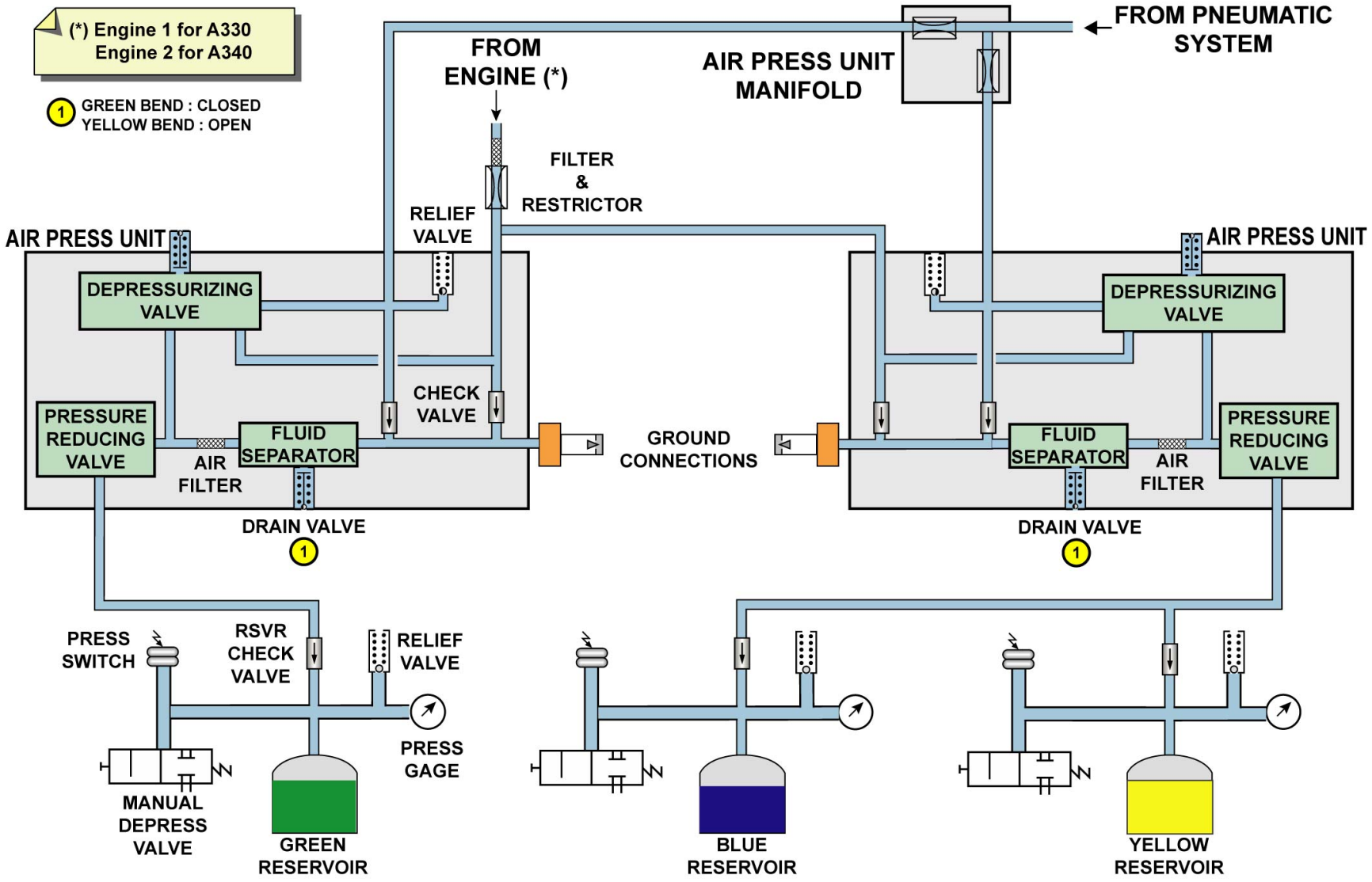
The supply to each reservoir is through a check valve, which will ensure that reservoir pressurization will be maintained up to 12 hours following a failure in the supply.

RESERVOIR MANIFOLD

An air pressure gage installed on each reservoir gives a direct reading of the reservoir pressure. The relief valve operates at 77 psi. Air is dumped overboard, and any fluid will pass into the seal drain system. The pressure switch operates at a falling pressure of 22 psi by sending a signal to the Hydraulic System Monitoring Unit (HSMU). It also gives a cockpit caution via the System Data Acquisition Computer (SDAC).

MANUAL DEPRESSURIZATION VALVE

Each reservoir manual depressurization valve is located on the associated service panel, and is operated manually.



SOURCES ... MANUAL DEPRESSURIZATION VALVE

G9409341 - GAUT0T0 - FM29P300000002

PRESSURIZATION PRESENTATION (2)

HYD. RESERVOIR DEPRESS/PRESS VIDEO PRESENTATION

This film presents the depressurization and pressurization of hydraulic reservoirs. The procedure being the same for the 3 reservoirs, the green one is shown as an example. The same applies for both the A 340 and the A 330.
We consider that the ground service network has been energized.
In the cockpit, make sure that there is no pressure in the BLEED system.
- Make sure that the Green hydraulic system is depressurized and put it in the maintenance configuration.
- Put a warning notice in position on panel 245VU so that nobody can pressurize the related hydraulic system.
- On the avionics compartment panel 721VU, open, safety and tag the green hydraulic pump control circuit breaker.
- Open the left main landing gear door.
- Open the green ground service panel 197CB.

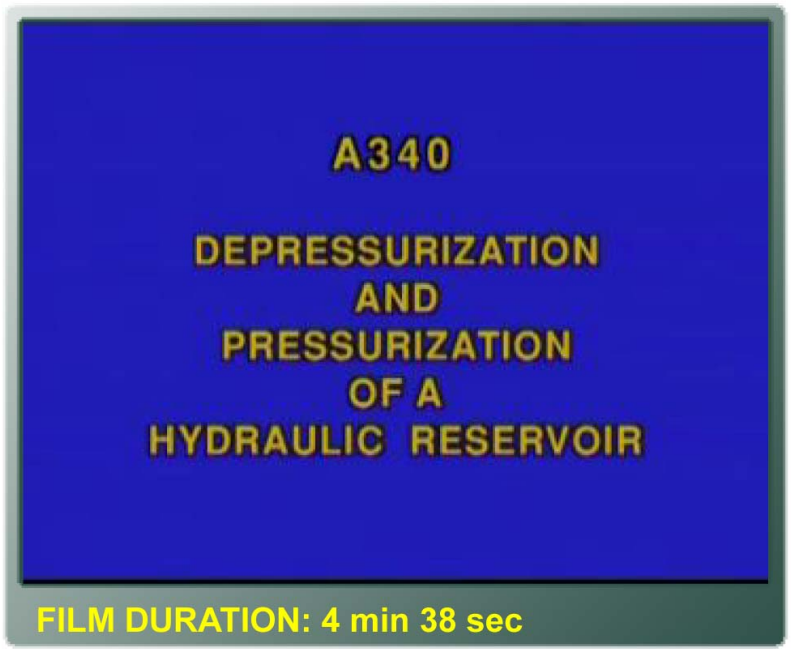
WARNING: Before continuing the procedure, protect your hands and face from the air, which comes out when you open the reservoir manual depressurization valve. There could be a risk of burns from hot gas and contamination from hydraulic fluid.

- On the green ground service panel, turn the cap of the depressurization valve 90 degrees clockwise to the OPEN position.
- Listen to check that all the air is released.
- In the left main landing gear bay, check the depressurization on the green reservoir air pressure gage.

NOTE: A special tool for A300, 310, 320 family, 330 and 340 can also be used. When connected, the corresponding reservoir stays depressurized to prevent accidental re-pressurization.

First depressurize the reservoir using the manual depressurization valve as shown before. Then remove the cap assembly and connect the tool on the valve. Put the other hand of the tool in a container. Leave the tool connected as long as it is necessary. Disconnect it when the maintenance task is completed. Re-install the manual depressurization valve cap assembly. Make sure that the valve is in the CLOSED position. Put the aircraft in the configuration corresponding to the next operation.
The reservoirs will be automatically pressurized when the BLEED system is supplied or by using the charging points located on the BLUE hydraulic service panel.

G9409341 - GAUT0T0 - FM29P3000000002



HYD. RESERVOIR DEPRESS/PRESS VIDEO PRESENTATION

GREEN HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION

The green hydraulic system is pressurized via different components which will be described.

RESERVOIR

The green reservoir supplies hydraulic fluid to the engine pumps, the electric pump and the Ram Air Turbine (RAT). The reservoir is air-pressurized to 50 psi (in flight or ground) in order to avoid cavitation of the hydraulic pumps. It is designed to remain pressurized for at least 12 hours.
Various accessory components are installed on the reservoir. On the top of each reservoir, an air pressure switch monitors the air pressure inside the reservoir. A low level switch is installed on the middle of each reservoir and monitors the fluid quantity to activate a low level caution at 8 l remaining. An analog system, based on capacitive transmitters, permanently monitors the fluid level. A temperature transmitter installed on the return port of the reservoir, sends fluid temperature indications to the Hydraulic System Monitoring Unit (HSMU).

FIRE SHUT OFF VALVE (FSOV)

The Fire Shut Off Valve (FSOV) is composed of a ball valve and electric motor. It is located outside the engine fire zone. The motor section contains limit switches for control and indications.

ENGINE DRIVEN PUMP (EDP)

The two-stage Engine Driven Pump (EDP) is controlled by a solenoid valve. When energized, the pump is set to the depressurized mode. The output of the pump is through an integral pulsation damper.

CASE DRAIN FILTER

Each EDP has a case drain line and filter, which is of the non-bypassing type, with a clogging indicator set to operate at 87 psi.

ELECTRIC PUMP

The two-stage electric pump is controlled by the HSMU. It is monitored for phase unbalance through the Current Unbalance Detection Unit (CUDU) and for overheat conditions.

RAM AIR TURBINE (RAT)

The RAT is an auxiliary pressure source for the green system and is supplied directly from the reservoir. Extension into the airflow is either manually selected or triggered by an automatic function.

GROUND CONNECTORS

For maintenance purposes, ground self-sealing connectors are installed on the service panel.

RETURN FILTER

The LP return filter is of the bypassing type, with a clogging indicator set to operate at 73 psi.

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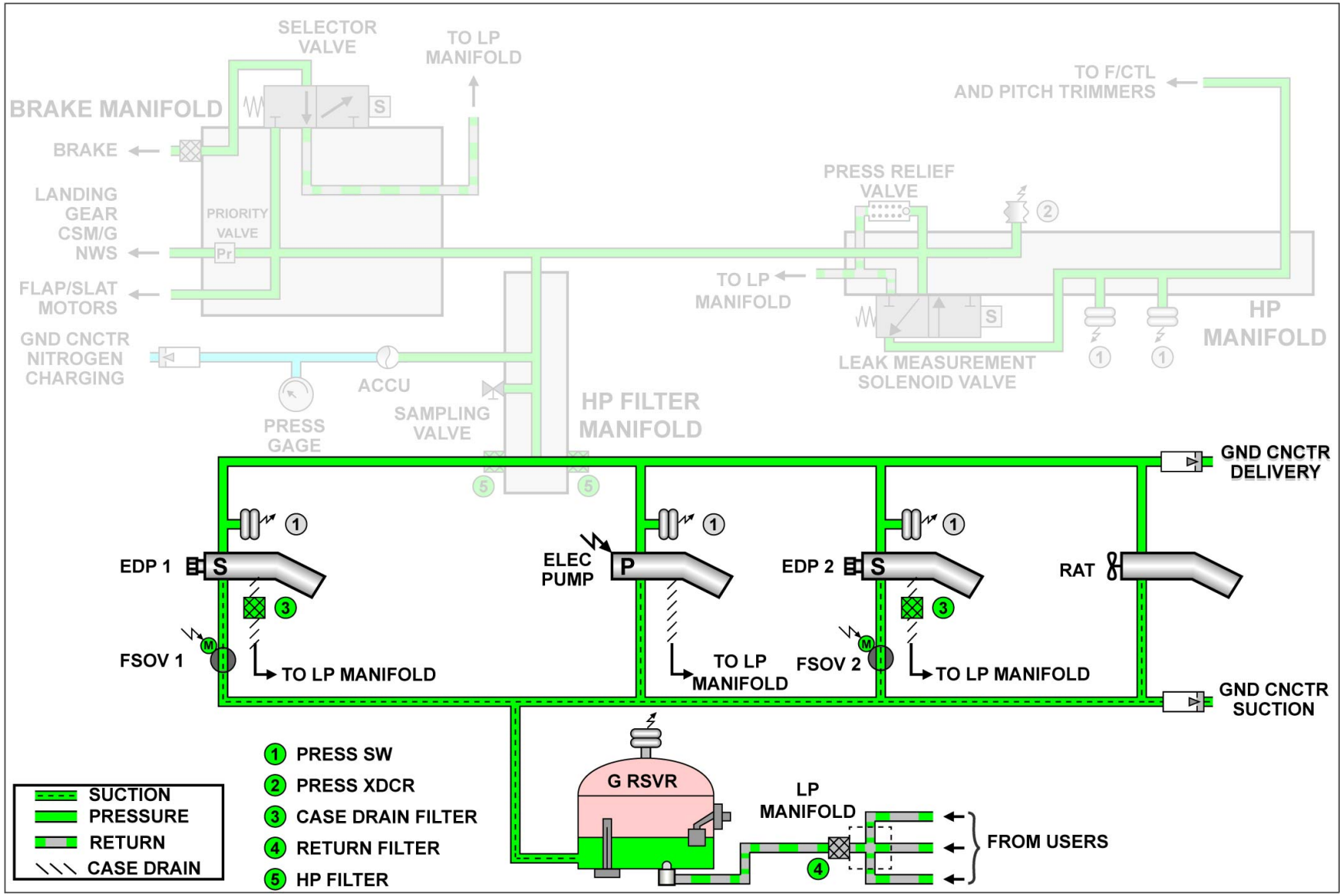

SYSTEM DESCRIPTION - RESERVOIR ... RETURN FILTER

GREEN HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

ACCUMULATOR

The power accumulator damps the pumps delivery pulsations and any pressure surges, and compensates for pump response time in the event of high flow demand. It is installed in vertical position and has two ports: a gas port at the upper end and a fluid port at the lower end. The gas port is connected via a pipe to a nitrogen charging ground connector and to a direct-reading pressure gage, which are installed on the green service panel.

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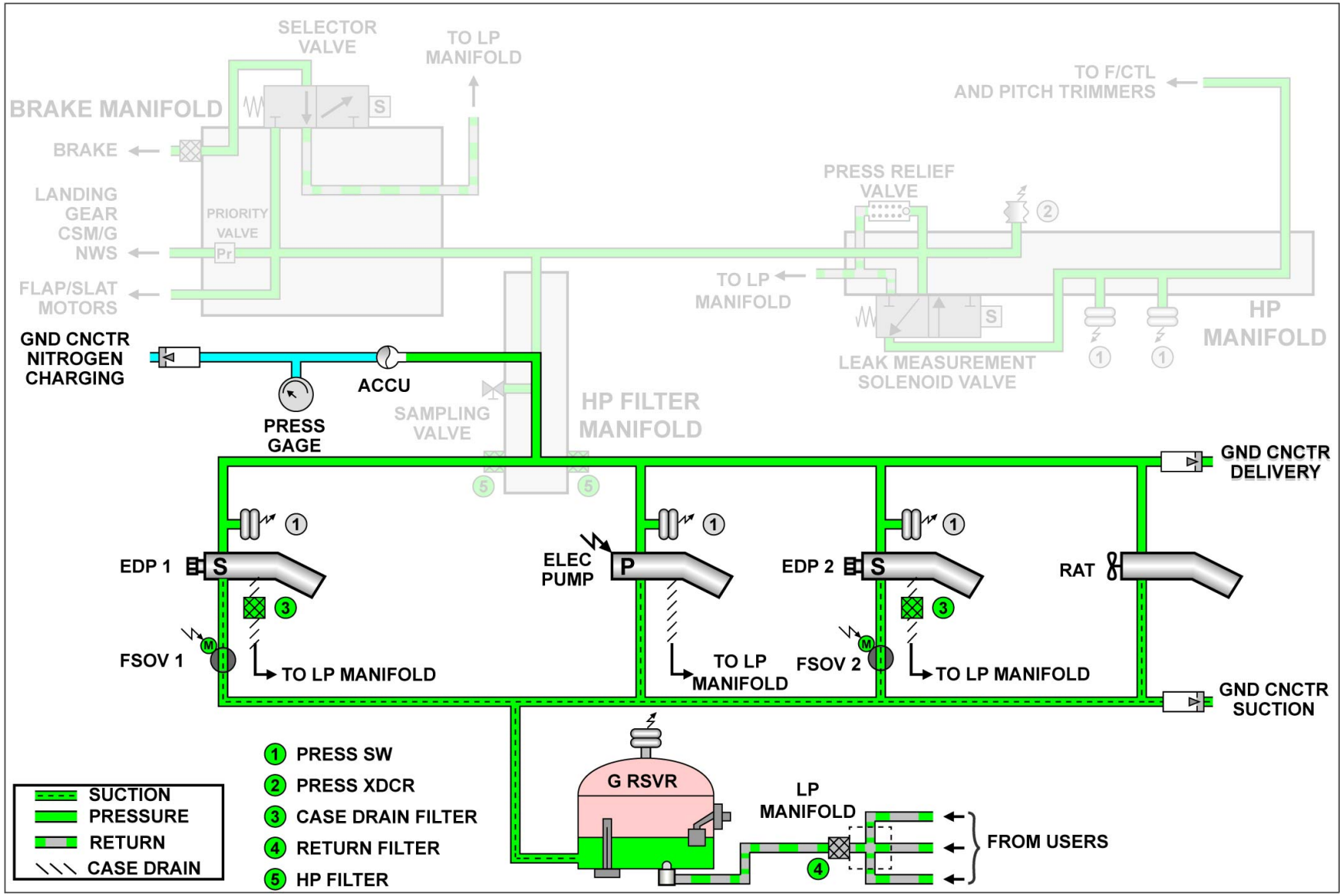

SYSTEM DESCRIPTION - ACCUMULATOR

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GREEN HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

HP FILTER MANIFOLD

The High Pressure (HP) filters are of the non-bypassing type, with a clogging indicator set to operate at 87 psi. A clogging indicator is installed on each filter. The sampling valve is used to take samples of hydraulic fluid to monitor for contamination.

CAUTION: When sampling, let the fluid run for a moment into a container, then put 0.2L (0.05USGal) of fluid into an appropriate bottle for analysis.

BRAKE MANIFOLD

The brake manifold supplies the user equipment of the brakes and flap/slat motors. A priority valve can isolate the supply of the landing gear and Constant Speed Motor/Generator (CSM/G) during a possible drop of pressure in the system. The HP filter manifold supplies the user equipment of the landing gear and CSM/G.

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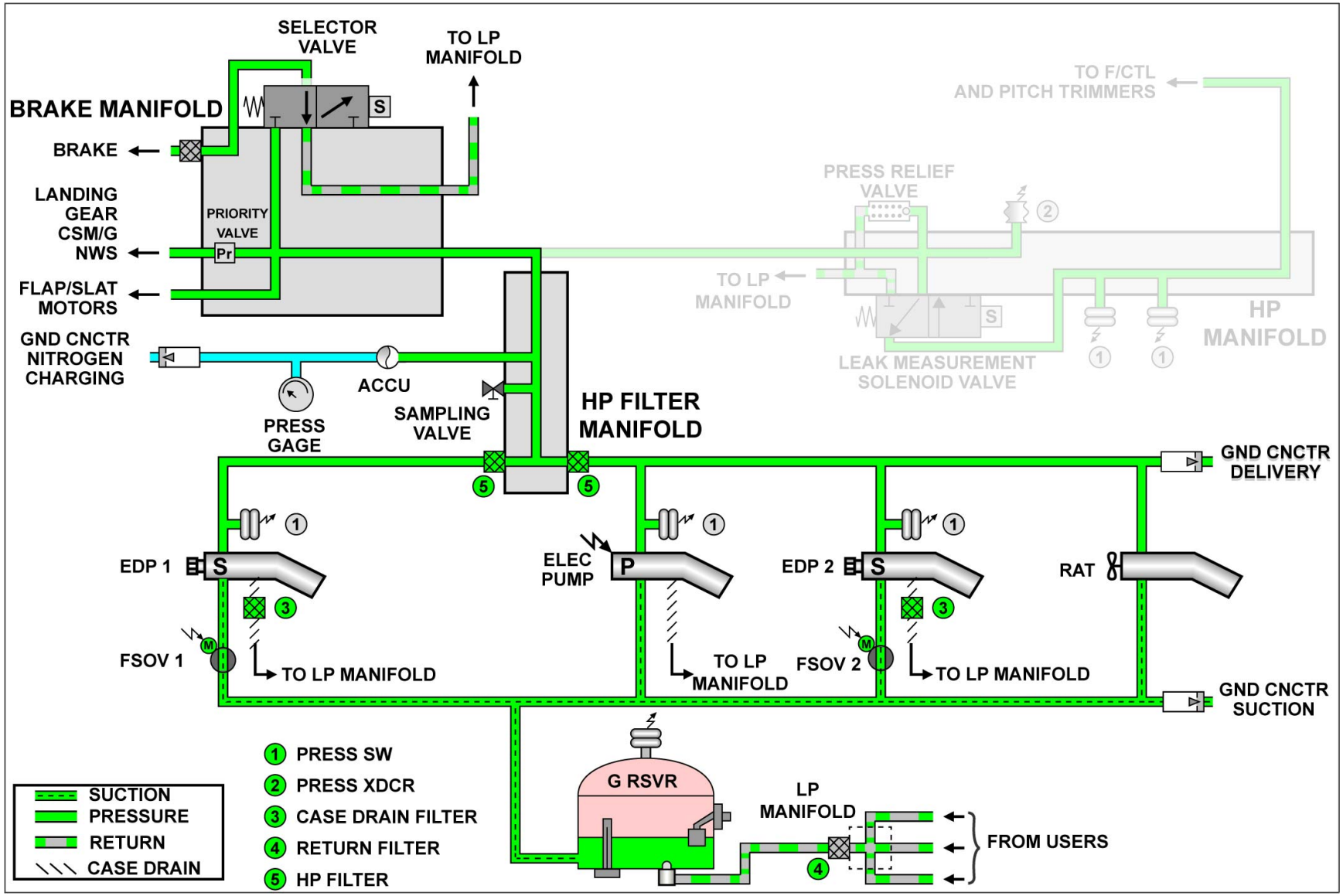

SYSTEM DESCRIPTION - HP FILTER MANIFOLD & BRAKE MANIFOLD

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GREEN HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

HP MANIFOLD

The HP manifold supplies the flight control users through the green ground service manifold. The green HP manifold includes various components. A pressure relief valve returns the fluid directly to the reservoir if an overpressure occurs. A leak measurement solenoid valve can be selected shut to isolate the supply to the flight controls, when the aircraft is on the ground. A pressure transducer and two pressure switches give pressure information to the ECAM and flight control computers.

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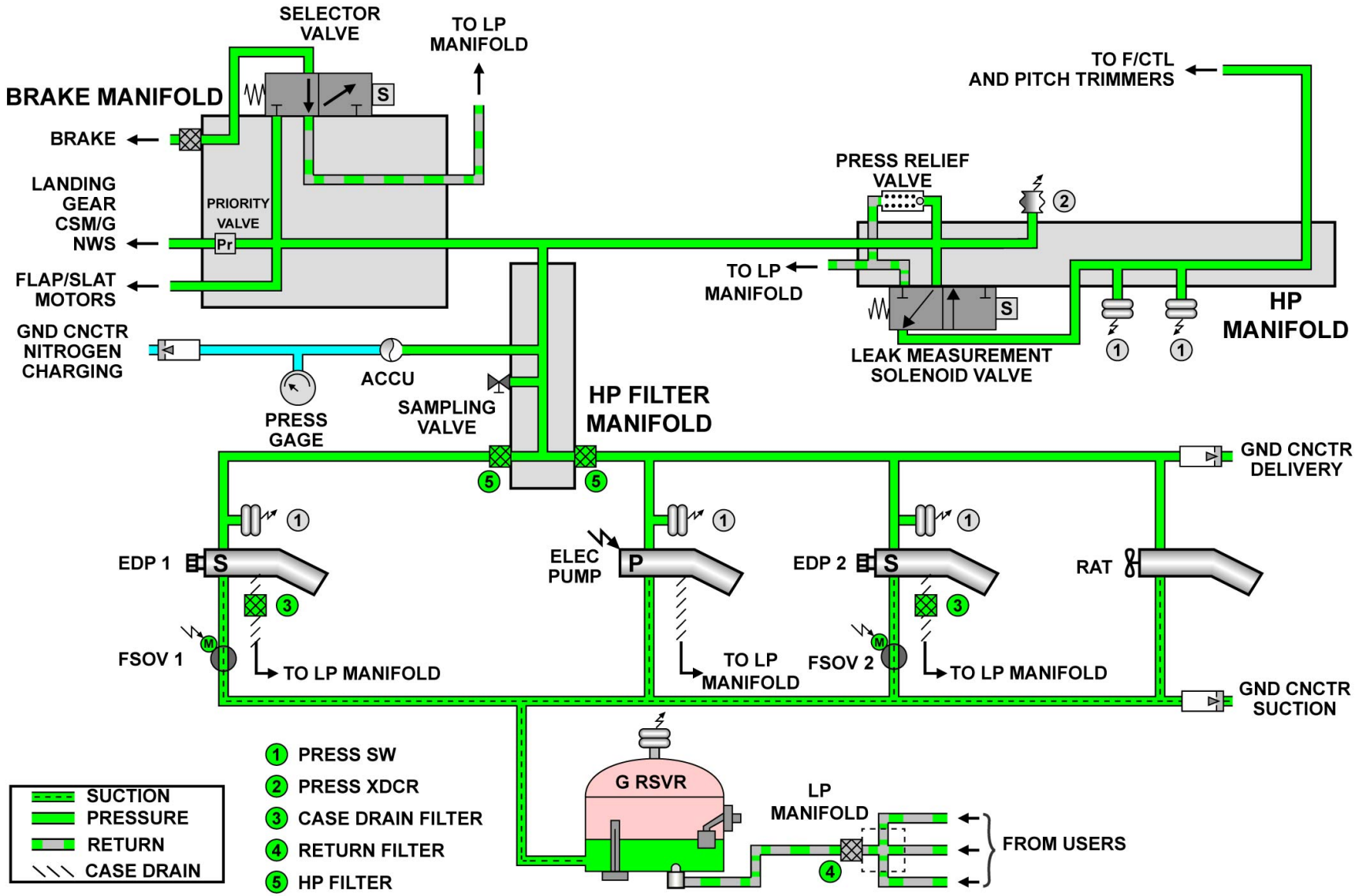

SYSTEM DESCRIPTION - HP MANIFOLD

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GREEN HYDRAULIC SYSTEM D/O (3)

RESERVOIR

The air pressure switch sends a discrete signal to the HSMU and System Data Acquisition Concentrators (SDACs), when the air pressure in the reservoir decreases to 22 psi. The HSMU uses this signal to elaborate its internal logic and controls the FAULT legends on the P/BSW. The same signal is used by the SDACs for the ECAM indication and associated warning. When the air pressure increases to 25 psi, the FAULT legend goes off. A quantity transmitter elaborates a 1 to 9 V analog signal which corresponds to the level of fluid in the reservoir. When a low level is detected, the low level switch sends a discrete signal to the HSMU and SDACs.
The HSMU uses this signal to elaborate its internal logic and to control the FAULT legend on the P/BSW. The same signal is used by the SDACs for the ECAM indication and associated warning. The temperature transmitter sends its analog information to the HSMU. The computer converts the received signal into a voltage, which is between 1 to 9 V. This signal is used for temperature compensation of the ECAM fluid level fill band and overheats detection (1 V corresponding to -60ºC, 9 V corresponding to +120ºC).
When the fluid temperature reaches 95ºC, the HSMU generates an overheat signal and the FAULT legend comes on, on the yellow HYD P/BSW. A copy of this overheat signal is also sent to the SDACs for the ECAM indication and associated warning.

NOTE: Note: The amber OVHT message stays on as long as the sensor detects the overheat.

From the fluid temperature and level gage signals, the HSMU elaborates a 1 to 9 V analog signal, which corresponds to the reservoir filling correction to execute. These signals are sent to the filling correction indicator located on the green ground service panel, via the filling selector valve.

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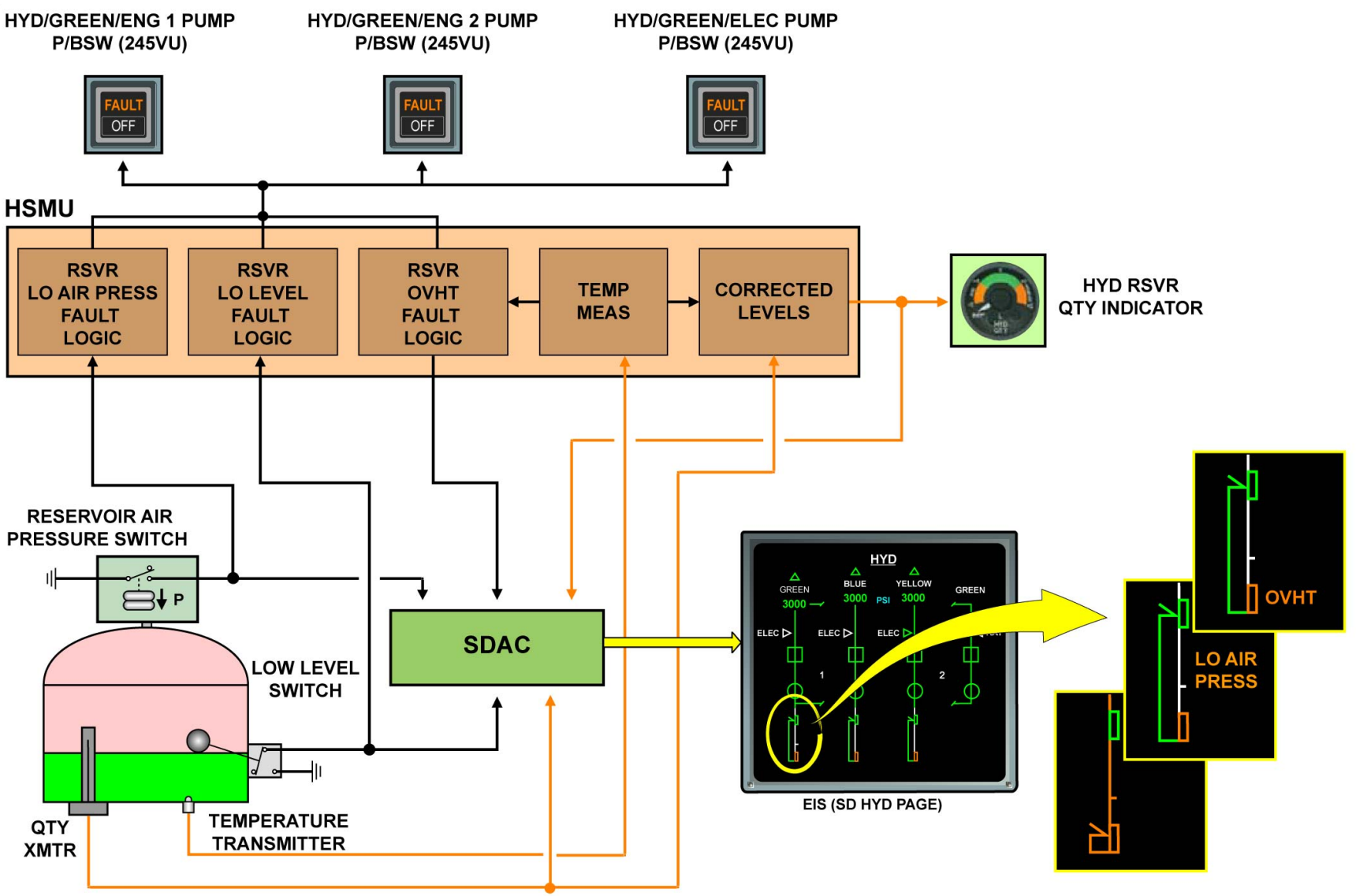

RESERVOIR

G9409341 - GAUT0T0 - FM29D1000000003

GREEN HYDRAULIC SYSTEM D/O (3)

FSOV LOGIC OPERATION

The engine 2 FSOV is supplied with 28 VDC either from BUS 2 or from the ESS BUS. The engine 1 FSOV is supplied with 28 VDC from the ESS BUS. In case of engine fire, the crew closes the associated engine 1 or 2 FSOVs. This stops the fluid supply to the engine pump.
In case of green reservoir low level (level switch threshold), the HSMU makes sure that the closing of the engines 1 and 2 FSOVs is automatic, this automatic closing function is inhibited for 30 seconds after changing the L/G control lever from UP to DOWN. Following an automatic closure of the FSOVs, it is necessary to do a system reset by tripping and resetting a circuit breaker. The status of the FSOV is displayed on the ECAM.
Both engine green hydraulic FSOVs are automatically closed by the HSMU, in the event of a green reservoir low level. If the blue and yellow reservoir levels are normal, 150 seconds after the initial closure of the FSOVs, they are re-opened to lubricate and avoid damage to the EDPs.
In case of a further blue or yellow reservoir low level, the green FSOVs remain closed enabling the green system to be restored by using the RAT.
The flight crew cannot re-open the FSOVs in flight, once they have been automatically closed.

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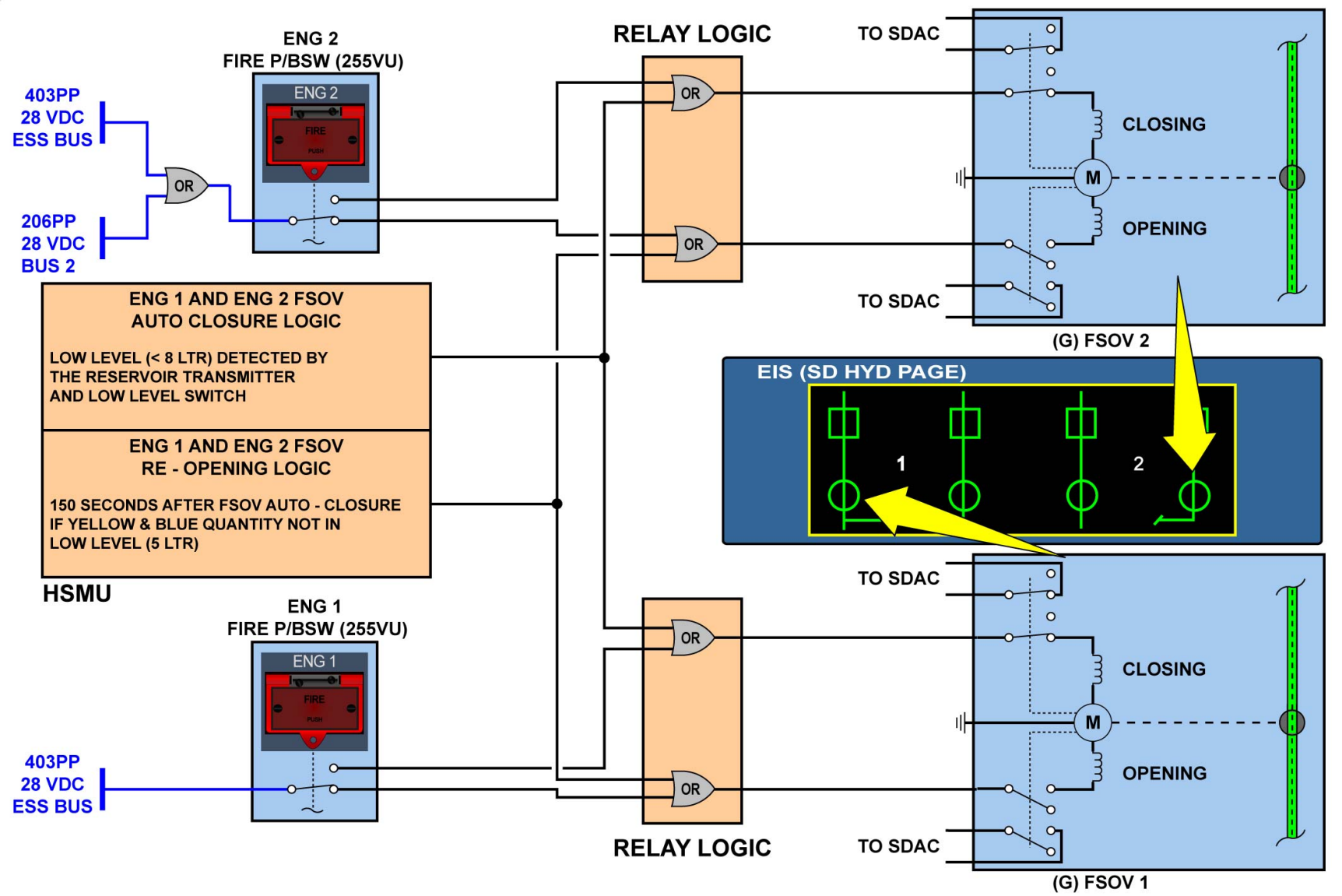

FSOV LOGIC OPERATION

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GREEN HYDRAULIC SYSTEM D/O (3)

EDP LOGIC OPERATION

As the principle is the same for EDP 1 and EDP 2, EDP 1 has been chosen for the example. As soon as engine 1 is running, the pump pressurizes the system to 3000 psi. A pressure switch monitors the output of each pump. If the pressure drops below 1750 psi, while the engine is running, the fault indication of the HSMU comes on, on the engine P/BSW. The pressure switch also sends signals to the SDAC for ECAM indication and associated warnings for a pump low pressure. The fault indication is inhibited when there is no signal from the Engine Electronic Controller (EEC).

When the green engine 1 pump P/BSW is set to OFF, the depressurization solenoid valve of the corresponding pump is energized and the pump no longer supplies fluid. In this case, the related OFF legend comes on. In flight, following an engine flame-out (N3<50%), the HSMU will energize the associated EDP solenoid valve. This is to easily get a restart during wind milling, by maintaining the engine pump in the depressurized mode until idle speed is reached (only on R/R T700 engine).

In the event of a green reservoir low level, if the blue and yellow reservoir levels are normal, 150 seconds after the initial closure of the FSOVs, EDPs are de-energized and the FSOVs are re-opened to lubricate and avoid damage to the EDPs.

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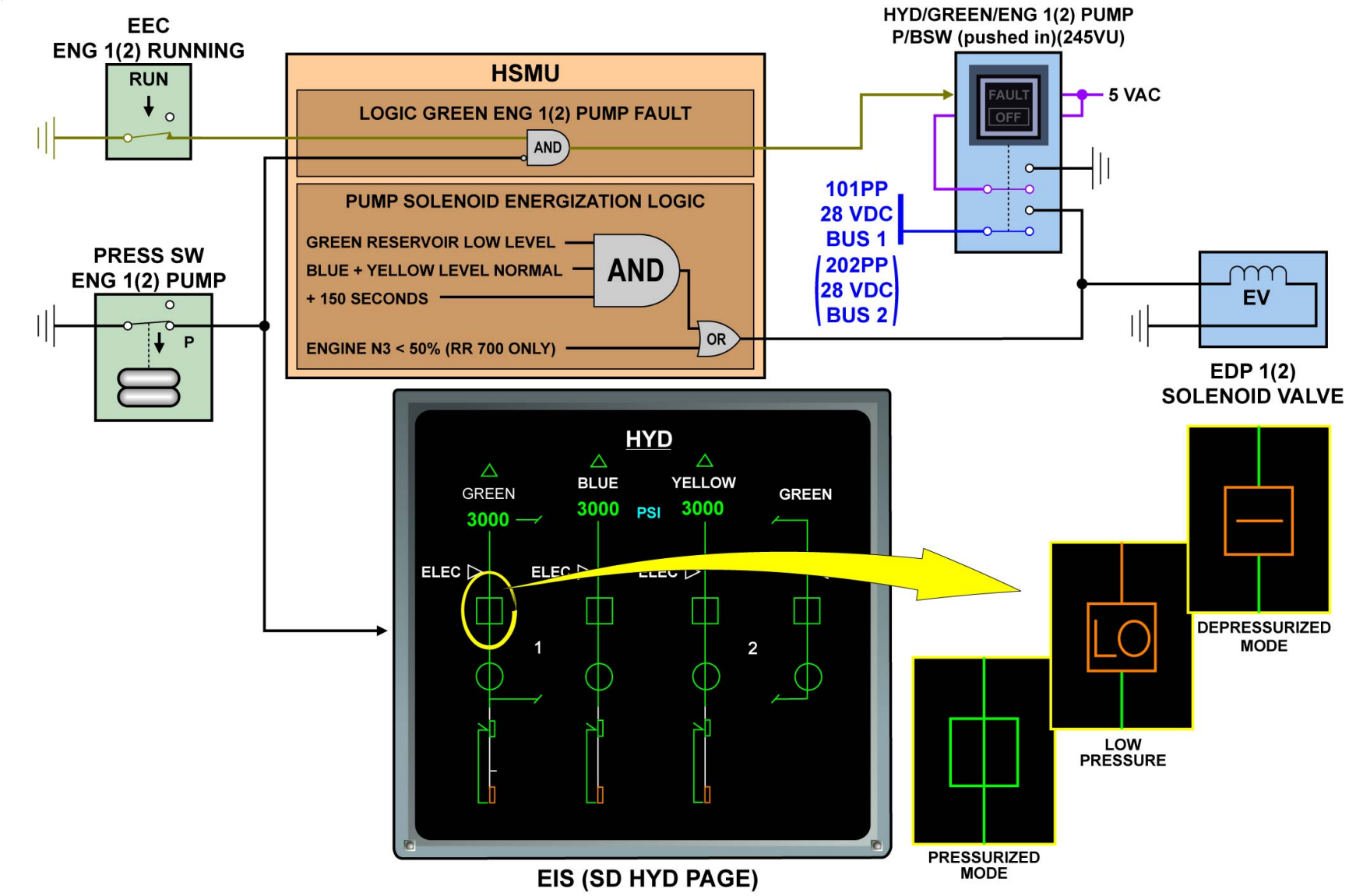

EDP LOGIC OPERATION

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION

STAND-BY (PUMP OFF)

GENERAL:
The control of the green electric pump operation relies on the P/BSW 4JV, 8JV, the HSMU and a RCCB (Remote Control Circuit Breaker). The motor of the green electric pump is supplied from the 1XP1 bus (115VAC triphase) through the RCCB. The green electric pump can be controlled either manually from the P/BSW 8JV or automatically by the HSMU.
STAND-BY CONFIGURATION:
In stand-by configuration the 28VDC electric pump control loop (4JV / 8JV / HSMU / RCCB) is open; the coil of the RCCB is de-energized; the RCCB is open; the electric pump motor is not supplied; the pump is stopped.

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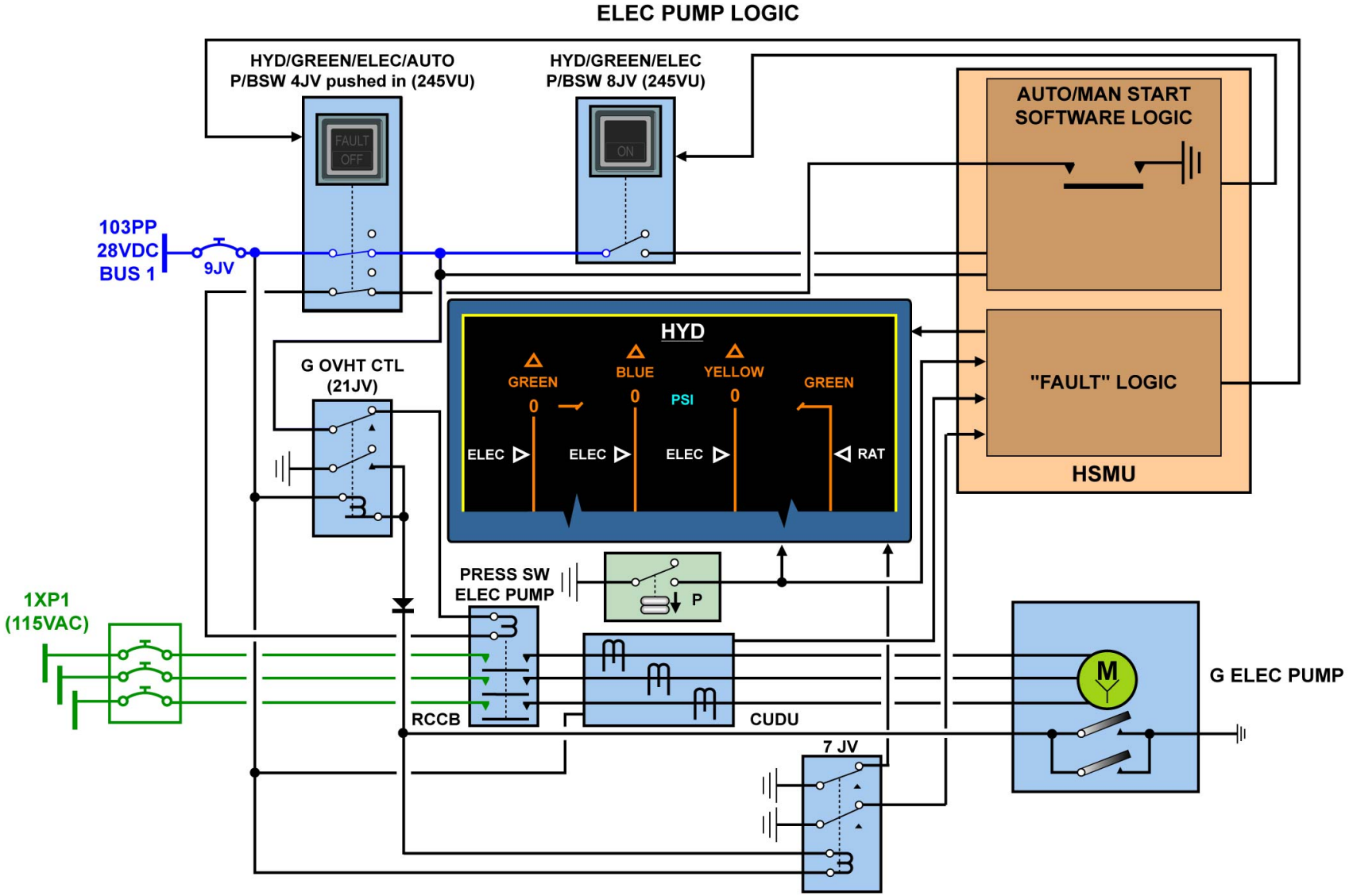

ELEC PUMP LOGIC OPERATION - STAND-BY (PUMP OFF)

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION (continued)

PUMP START

MANUAL START:
By pressing the 8JV pulse P/BSW the HSMU gets a +28 VDC signal. Getting this signal, by software logic, the HSMU closes the electrical pump control loop. The RCCB coil is energized; the RCCB closes; the electric pump motor is supplied by the 115 VAC; the pump starts running.
The HSMU also controls the illumination of the cyan ON legend on the 8JV pulse P/BSW.

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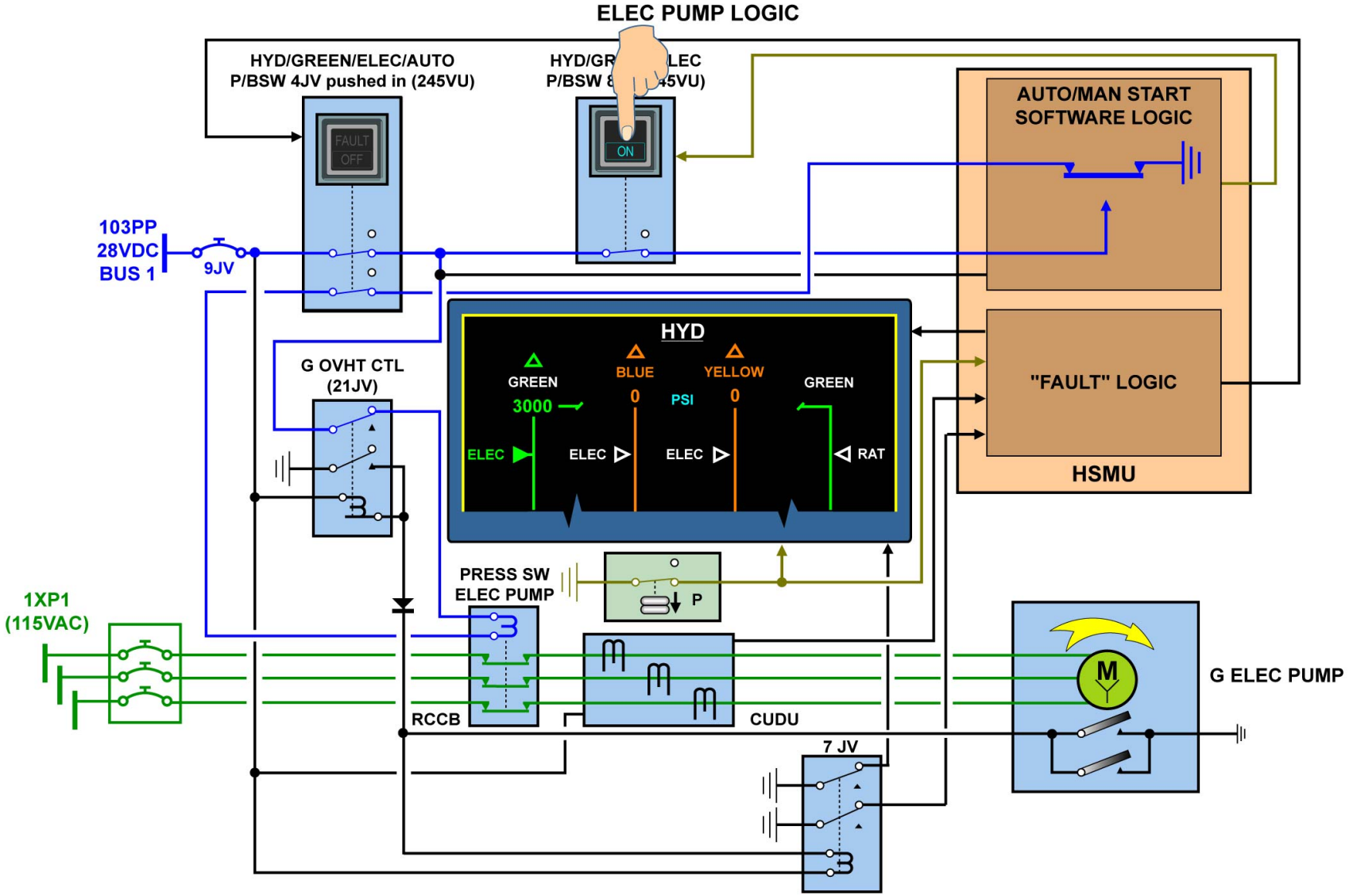

ELEC PUMP LOGIC OPERATION - PUMP START

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION (continued)

PUMP RUNNING

PUMP RUNNING:
When the 8JV pulse P/BSW is released the HSMU does not get any longer the +28VDC signal but, by software logic, keeps the electric pump control loop closed. The RCCB is kept energized closed; the electric pump keeps running; the cyan "ON" legend is kept illuminated by the HSMU.
MANUAL STOP:
By pressing again the 8JV pulse P/BSW while the electric pump is running the HSMU gets a new + 28 VDC signal. Getting this new signal, by software logic, the HSMU opens the electric pump control loop; the RCCB coil is de-energized; the RCCB opens; the electrical pump motor is no longer supplied by the 115 VAC; the pump stops running.
The HSMU also controls the cyan "ON" legend on the 8JV pulse P/BSW to extinguish.
AUTOMATIC CONTROL:
The green electric pump can be controlled automatically by the HSMU. The control logic is as follows:
Aircraft in flight (input from LGCIU) AND airspeed above 100 kts (input from ADIRU) AND one engine failed (HP compressor below 50 % input from EIVMU) AND landing gear control lever selected UP => green electric pump runs for 25 seconds.
The purpose of this logic is to ensure that, with one engine failed (green hydraulic system pressurized by one EDP only), the landing gear retraction does not last longer than in normal configuration with two engines running (green hydraulic system pressurized by two EDP). Experiencing the aerodynamic drag of the gear in-transit configuration during an abnormal long time would not be compatible with the 50 % loss of engine thrust.

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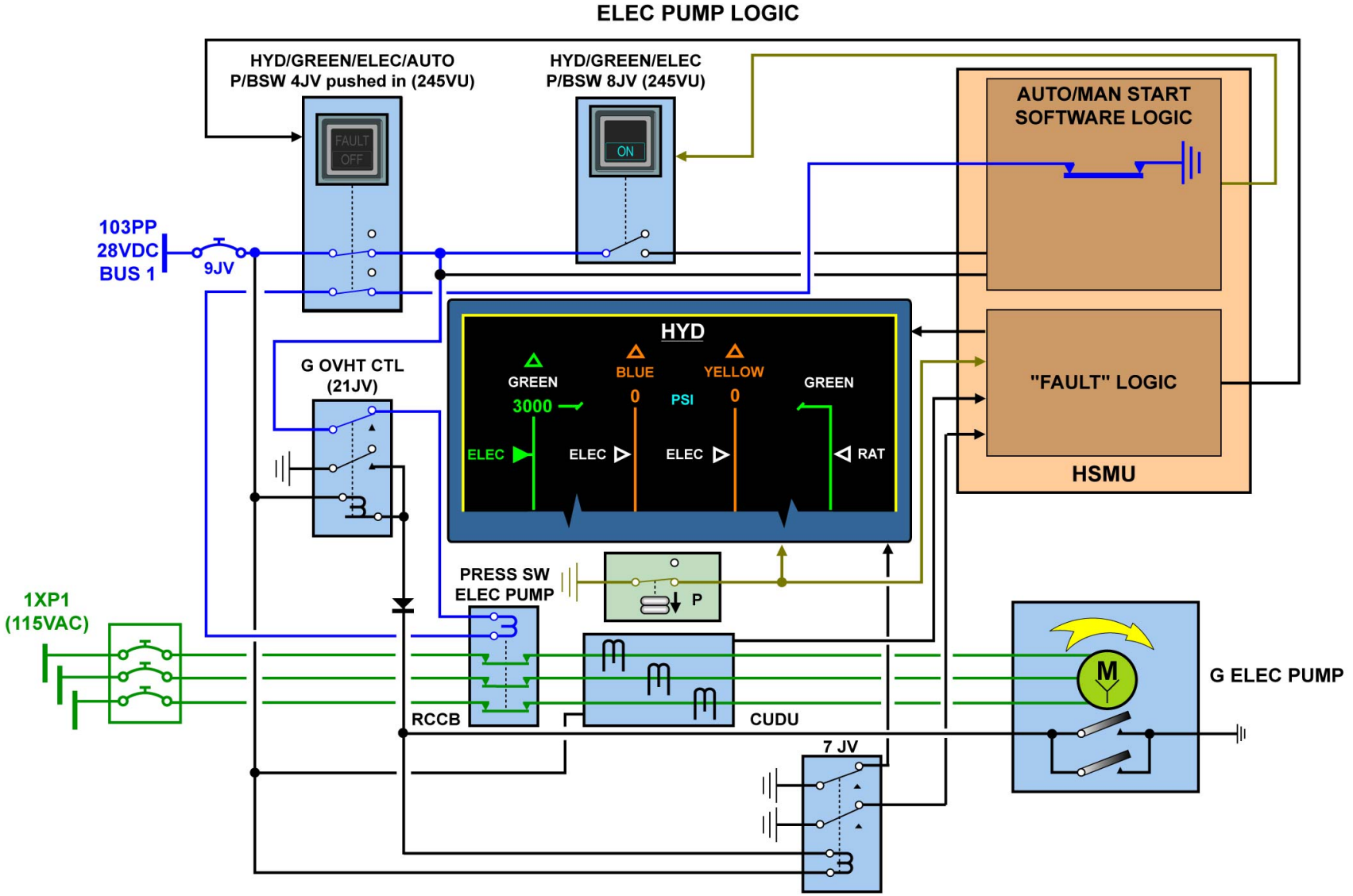

ELEC PUMP LOGIC OPERATION - PUMP RUNNING

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION (continued)

PUMP LOW PRESSURE

LOW PRESSURE:
The green electric pump delivers hydraulic pressure. A switch connected to the pressure line downstream of the pump monitors the hydraulic pressure.
During normal operation of the electric pump this pressure switch is closed sending to both, the EIS and the HSMU a ground signal.
If the delivered pressure drops below 1450 psi, the pressure switch opens; the ground signal from the pressure switch is lost by the EIS and the HSMU; the electric pump is displayed amber on the ECAM hydraulic system page by the EIS; the HSMU controls the amber FAULT legend on the 4JV P/BSW to illuminate.
These indications are inhibited if the electric pump is not commanded to run.
Note: The electric pump is not stopped automatically in case of low pressure being detected by the pressure switch. If it is stopped manually by releasing-out the 4JV P/BSW, the amber FAULT legend is extinguished by the HSMU, the white OFF legend illuminates, on the 4JV P/BSW and the cyan ON legend is extinguished on the 8JV P/BSW.

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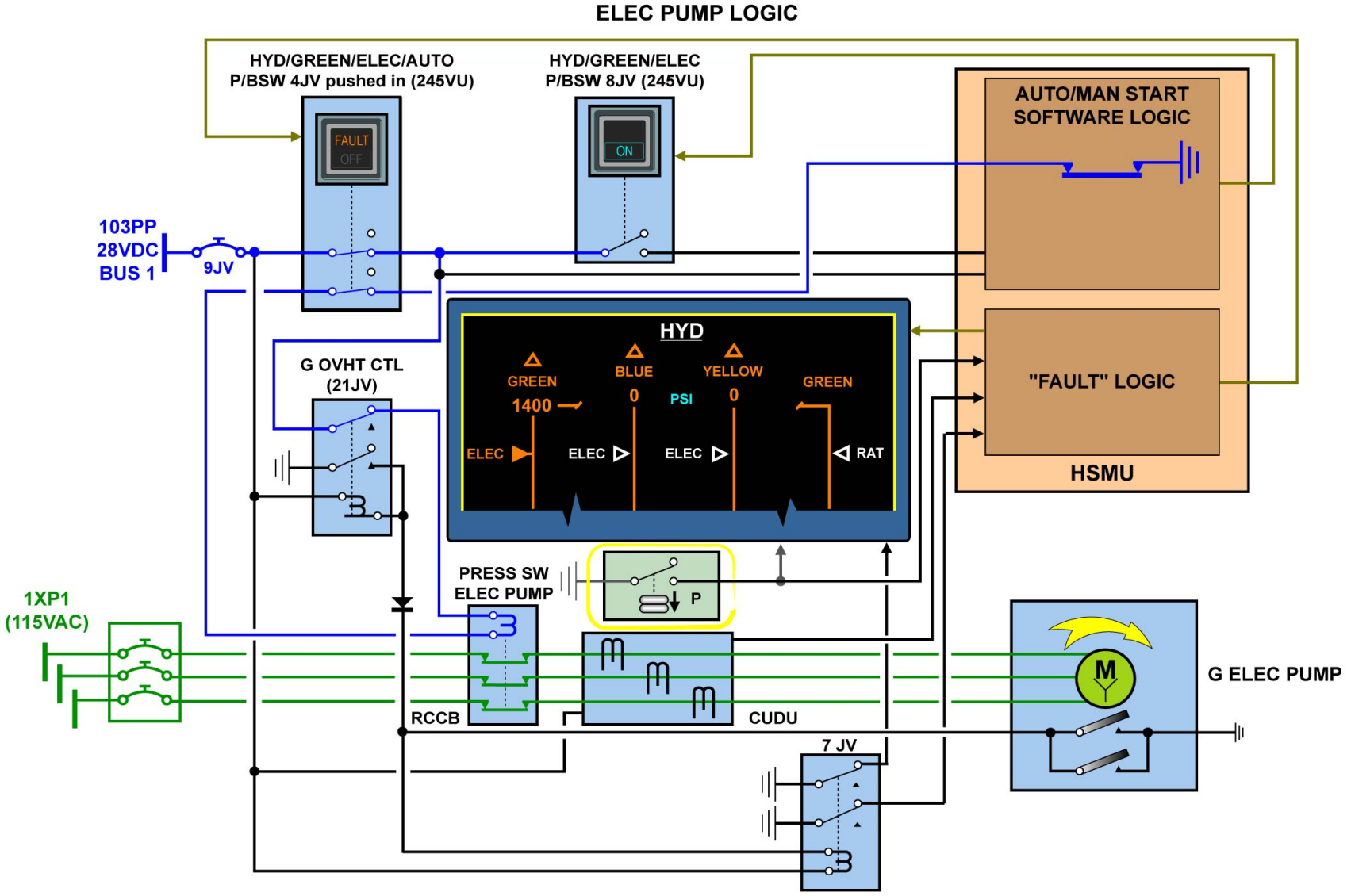

ELEC PUMP LOGIC OPERATION - PUMP LOW PRESSURE

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION (continued)

PUMP OVERHEAT

OVERHEAT:

In the event of a green electric pump motor overheating, the electric pump stops automatically; related indications are displayed; electric pump further operation is inhibited (even after cool down); reset is only possible on the ground.

The above logic is independent from the HSMU software, it is performed by a dedicated external circuit including three components:

-a thermal switch installed in the motor of the electric pump,

-a self-holding type relay (G OVHT CTL 21JV)

-an indication relay (7JV).

If the temperature of the electric pump motor reaches 230 deg.C (446 deg.F) the thermal switch closes; a ground is supplied to the coil of the relays 21JV and 7JV; both relays 21JV and 7JV are getting energized, they both open.

The opening of the relay 21JV causes the opening of the electric pump control loop; the RCCB coil is no longer energized, the RCCB opens; the motor of the electric pump is no longer supplied by the 115VAC; the electric pump stops running.

With the opening of the relay 7JV the ground signals received by the EIS and the HSMU are both lost; the EIS displays the electric pump in amber with the amber OVHT legend on the ECAM hydraulic system page; the amber FAULT is illuminated by the HSMU on the 4JV P/BSW. The cyan ON legend on the 8JV P/BSW is extinguished by the HSMU.

Note: If the 4JV P/BSW is released-out (as per ECAM procedure) the OFF white legend illuminates, but the amber FAULT legend is not extinguished by the HSMU.

When the temperature of the electric pump motor drops below the overheat threshold the thermal switch re-opens but the relay 21JV remains energized open (self-holding); the electric pump control loop is latched open making impossible any further start of the pump.

On the ground, reset of the 9JV C/B (not accessible in flight) makes possible to recover the control of the electric pump. Opening the 9JV C/B de-energizes the coil of the relay 21JV; the relay 21JV is unlatched and closes. After the 9 JV C/B has been closed the control loop of the electric pump is restored to the stand-by configuration.

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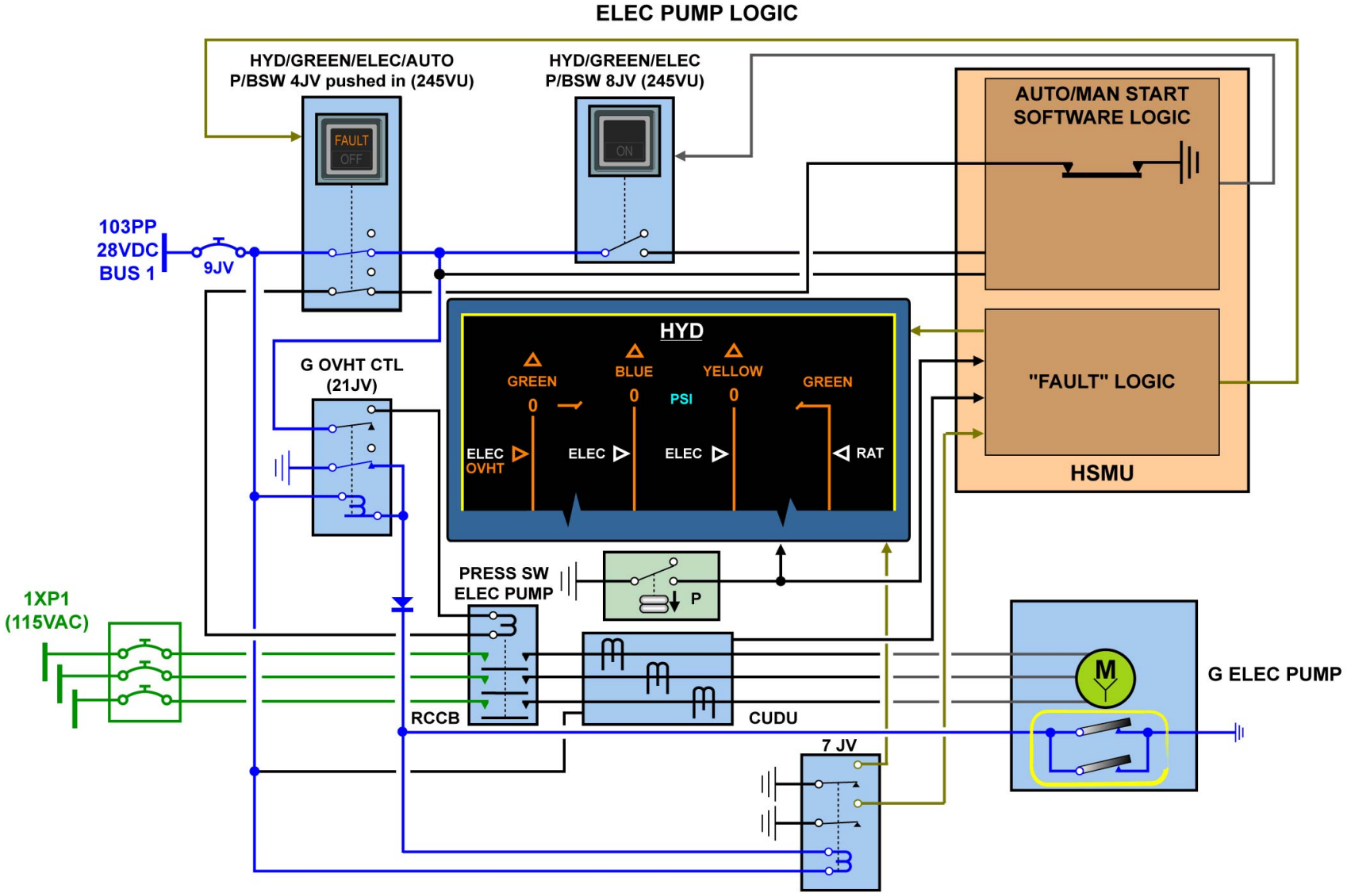

ELEC PUMP LOGIC OPERATION - PUMP OVERHEAT

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GREEN HYDRAULIC SYSTEM D/O (3)

ELEC PUMP LOGIC OPERATION (continued)

CURRENT UNBALANCE

UNBALANCE:

The 115 VAC triphase power supply of the electric pump is monitored by the CUDU (Current Unbalance Detection Unit). This component, based on the Hall effect sensor principle, measures and compares the electric currents of each individual phase of the electric pump power supply.

During normal operation of the electric pump, the currents of each individual phase are balanced.

In the event of a current unbalance between at least two phases, the CUDU signals the fault to the HSMU which, by software logic, opens the electric pump control loop; the RCCB is de-energized; the motor of the electric pump is no longer supplied; the electric pump stops running.

The fault signal sent to the HSMU is latched by the CUDU making it impossible any further start of the electric pump. To recover control of the electric pump the CUDU has to be de-powered / re-powered; this can be carried-out on the ground by a reset of the 9JV C/B.

In addition to the automatic stop of the pump, the HSMU also controls the amber FAULT legend to illuminate, on the 4JV P/BSW and the cyan ON legend to extinguish on the 8JV P/BSW.

Thanks to a test push-button on the CUDU, current unbalance condition can be simulated and automatic shut-down of the electric pump checked during maintenance.

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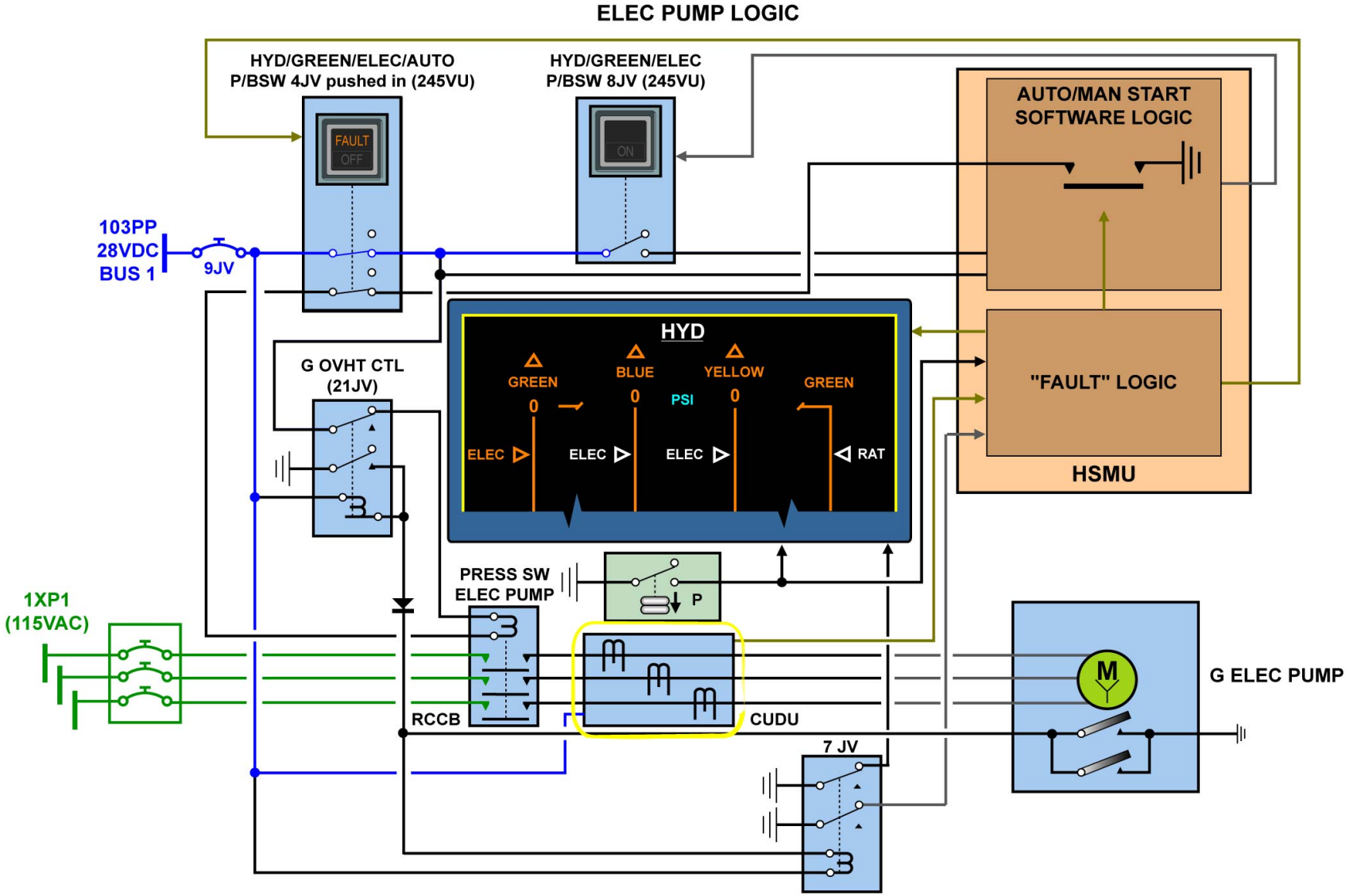

ELEC PUMP LOGIC OPERATION - CURRENT UNBALANCE

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GREEN HYDRAULIC SYSTEM D/O (3)

RAT LOGIC OPERATION

Manual deployment of the RAT is done by momentarily pushing the RAT MAN ON P/BSW on the overhead hydraulic panel. This connects the HOT BATTERY BUS to the deploy solenoid 1 to release the RAT uplock. The HSMU controls the automatic release of the RAT uplock by energizing solenoid 2, supplied by ESS BUS. This will occur in flight above 100 Kts under any of the following conditions:
- ENG1 and 2 failed,
- green and blue reservoir low level,
- green and yellow reservoir low level.

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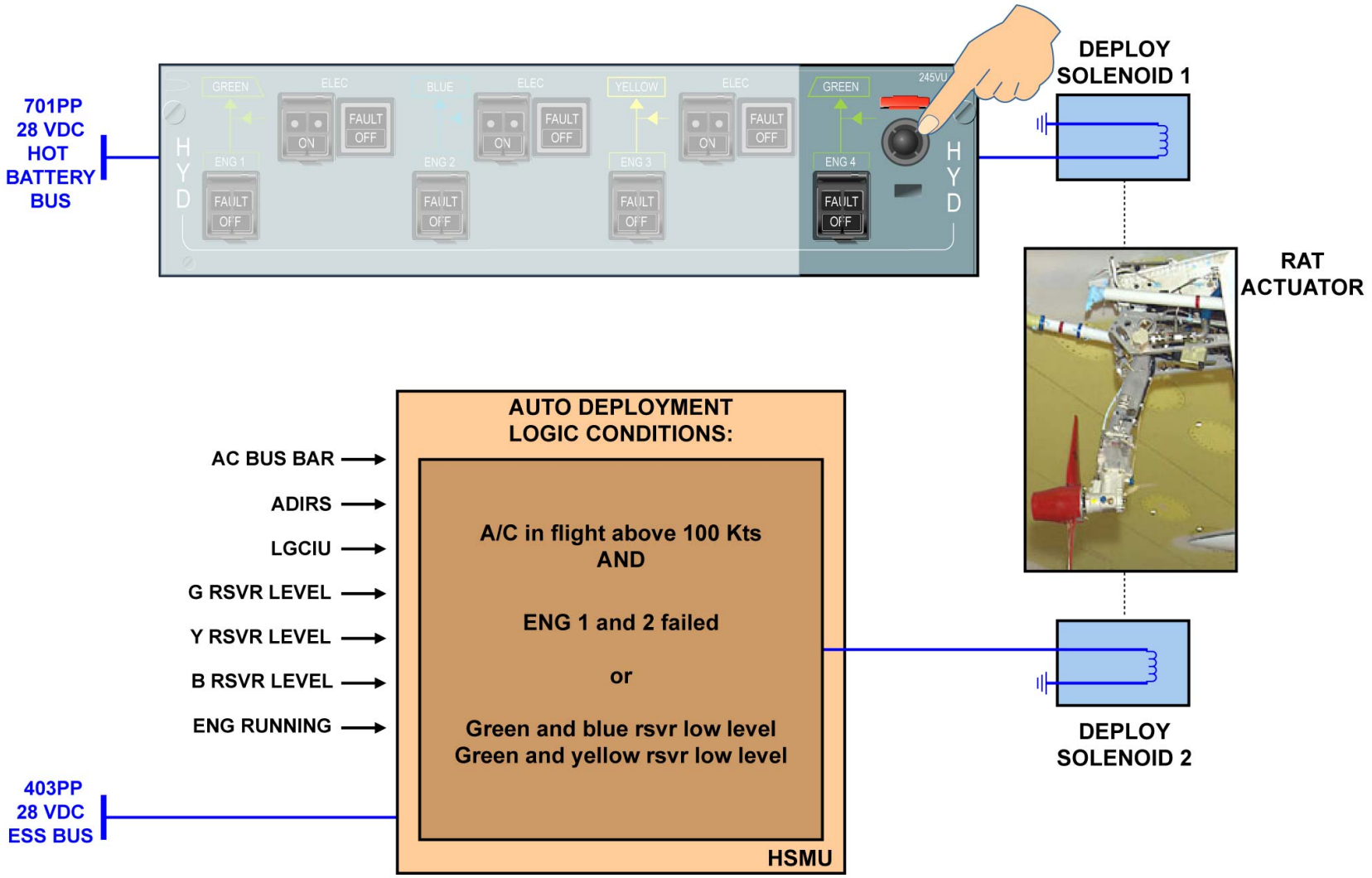

RAT LOGIC OPERATION

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GREEN HYDRAULIC SYSTEM D/O (3)

RAT LOGIC OPERATION (continued)

RAT TURBINE ASSEMBLY / RAT STOW PANEL

The RAT turbine assembly is installed in flap track n°4 of the right wing. It includes:
-The RAT turbine,
-The RAT leg assy,
-The RAT hydraulic pump,
-The RAT actuator,
-The RAT manifold.
At the front of the leg assembly, there is a blade index mechanism. It locks the turbine and blades so that they do not turn when the turbine is retracted or not fully extended. The mechanism is engaged when the arrows on the hub and the lower leg gearbox are lined up. It automatically disengages when the RAT is approximately 10 degrees from full extension position.
The LAMP TEST switch is used for a lamp test of the STOWED lamp, the re-stow INTERLOCK WARNING lamp and the ACTUATOR PRESSURE lamp. When you press it, all lamps come on. When you release it, all lamps go off.

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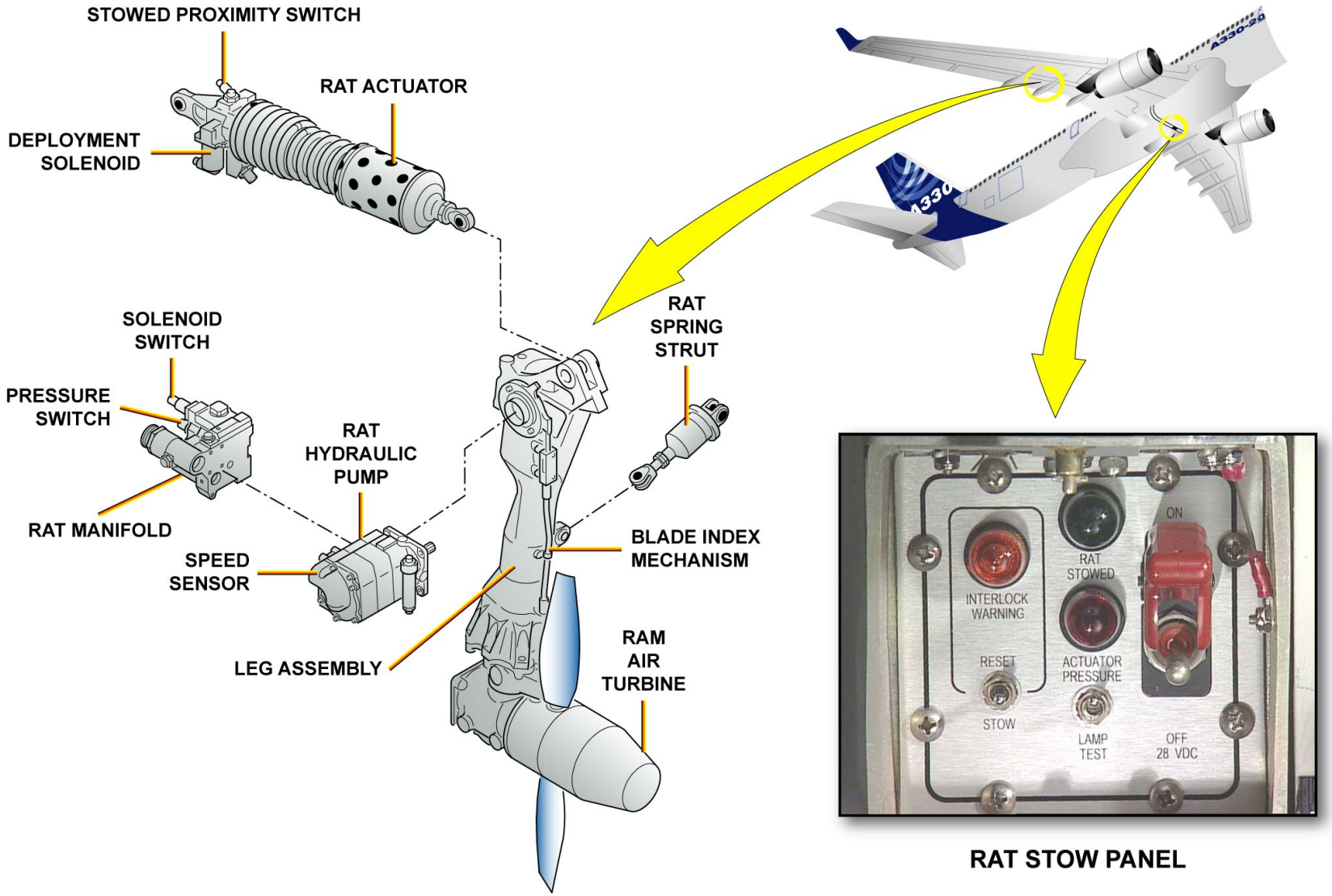

RAT LOGIC OPERATION - RAT TURBINE ASSEMBLY / RAT STOW PANEL

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GREEN HYDRAULIC SYSTEM D/O (3)

CURRENT UNBALANCE DETECTOR UNITS (CUDU)

The CUDUs monitor the supply current of the electric pumps. They detect a current unbalance or the cut-off of one or two phases in the three phases power supply of the electric pumps. They send, to the HSMU, a signal to cut-off the power supply of the contactors related to the electric pumps when they detect an unbalance between the three phases. Switching off the power supply of the current unbalance detector units launches the reset.
A test pushbutton associated to an annunciator light comes on when the test has been done and the CUDU operates properly.

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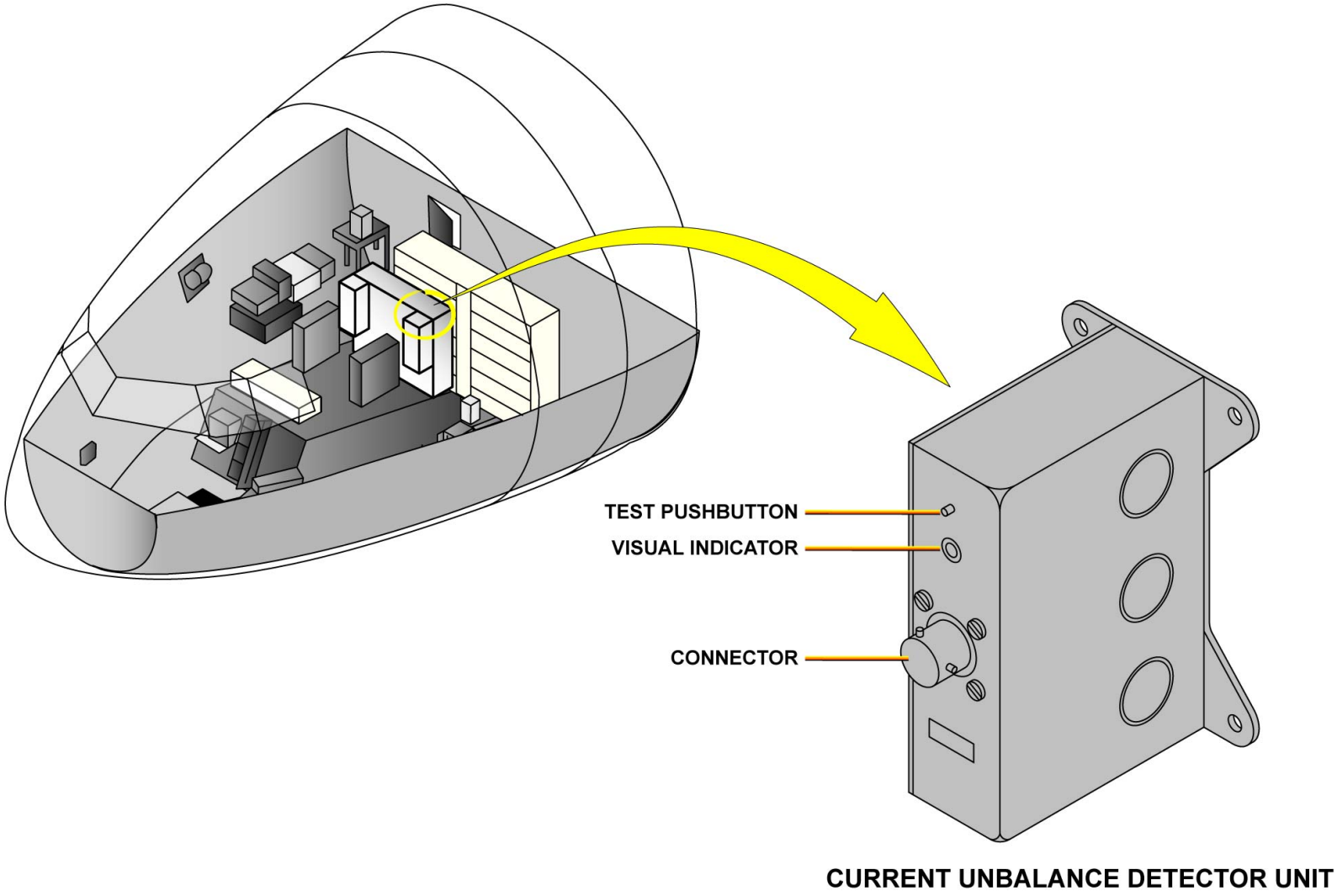

CURRENT UNBALANCE DETECTOR UNITS (CUDU)

GREEN HYDRAULIC SYSTEM D/O (3)

DISTRIBUTION INDICATIONS

The pressure transducer (6JS1) sends an analog signal, which is used to give a hydraulic system pressure indication on the hydraulic ECAM page. This same signal is also sent to the flight control system in order to give the pressure indication. The leak measurement solenoid valve is normally de-energized open. Selecting OFF, at the maintenance panel, will energize the valve to close off the supply to the flight control system. The solenoid power supply is inhibited in flight above 100 Kts using information from Air Data/Inertial Reference Unit 1 (ADIRU 1) and Landing Gear Control and Interface Units (LGCIUs).
The pressure switch (19CE1) sends a discrete signal, if the pressure is less than 1450 psi. This signal is used for ECAM indication on the hydraulic page and for warning messages. This signal is also used by the flight control system. The pressure switch (7JS1) only gives pressure information to the flight control system and to the Brake/Steering Control Unit (BSCU). The ground service manifold is used during the ground leak test, to selectively let the hydraulic supply to the flight controls when the leak measurement valve is closed.

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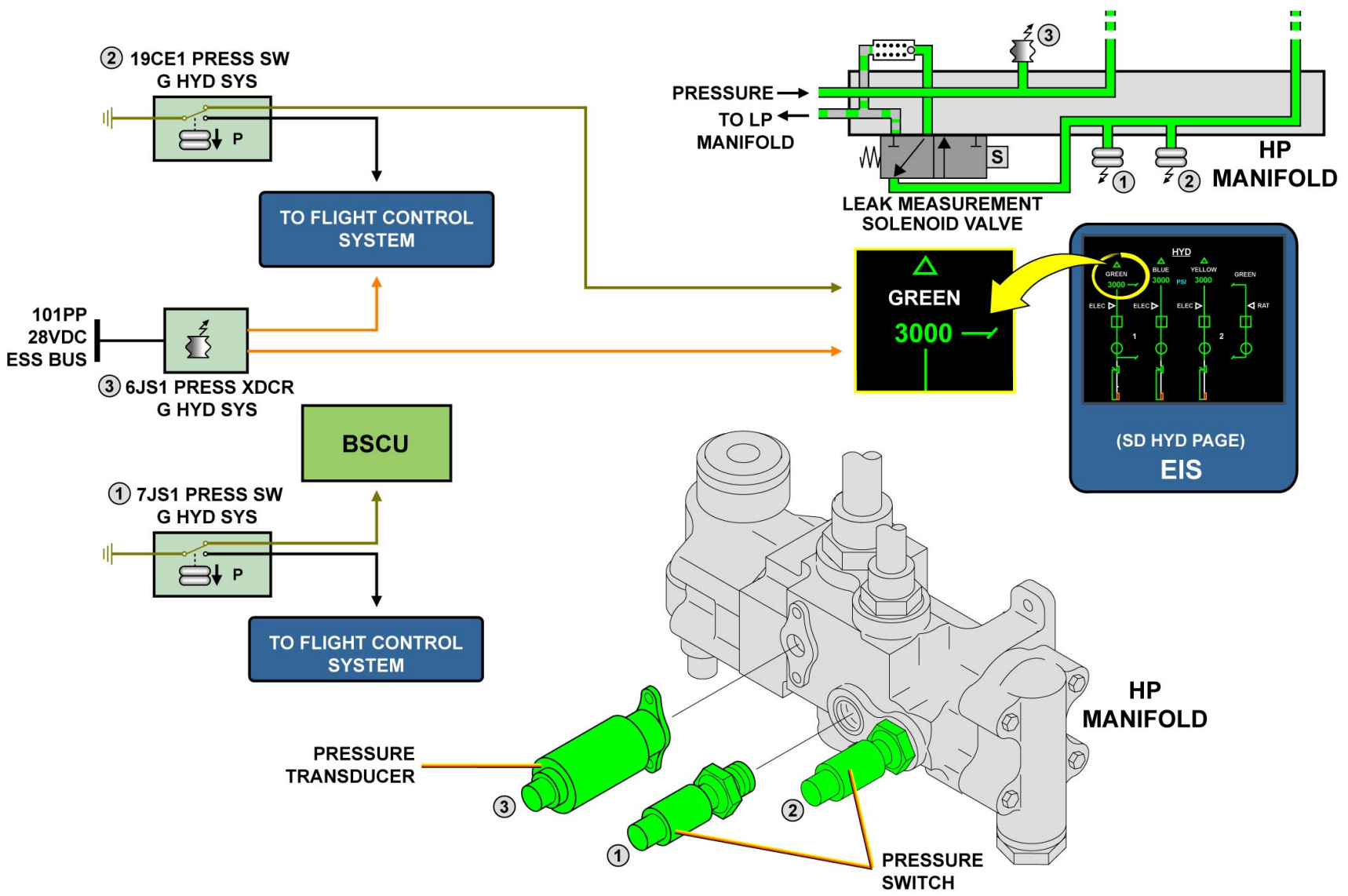

DISTRIBUTION INDICATIONS

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BLUE HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION

The blue hydraulic system is pressurized via different components which will be described.

RESERVOIR

The blue reservoir supplies hydraulic fluid to the engine pump and the electric pump. The reservoir is air-pressurized to 50 psi (in flight or ground) in order to avoid cavitation of the hydraulic pumps. It is designed to remain pressurized for at least 12 hours.
Various accessory components are installed on the reservoir. On the top of each reservoir, an air pressure switch monitors the air pressure inside the reservoir. A low level switch is installed on the middle of each reservoir and monitors the fluid quantity to activate a low level caution at 5l remaining. An analog system, based on capacitive transmitters, permanently monitors the fluid level. A temperature transmitter installed on the return port of the reservoir, sends fluid temperature indications to the Hydraulic System Monitoring Unit (HSMU).

FIRE SHUT OFF VALVE (FSOV)

The Fire Shut Off Valve (FSOV) is composed of a ball valve and electric motor. It is located outside the engine fire zone. The motor section contains limit switches for control and indications.

ENGINE DRIVEN PUMP (EDP)

The two-stage Engine Driven Pump (EDP) is controlled by a solenoid valve. When energized, the pump is set to the depressurized mode. The output of the pump is through an integral pulsation damper.

CASE DRAIN FILTER

Each EDP has a case drain line and a filter, which is of the non-bypassing type, with a clogging indicator set to operate at 87 psi.

ELECTRIC PUMP

The two-stage electrical pump is controlled by the HSMU, and is monitored for phase unbalance through the Current Unbalance Detection Unit (CUDU), and for overheat conditions.

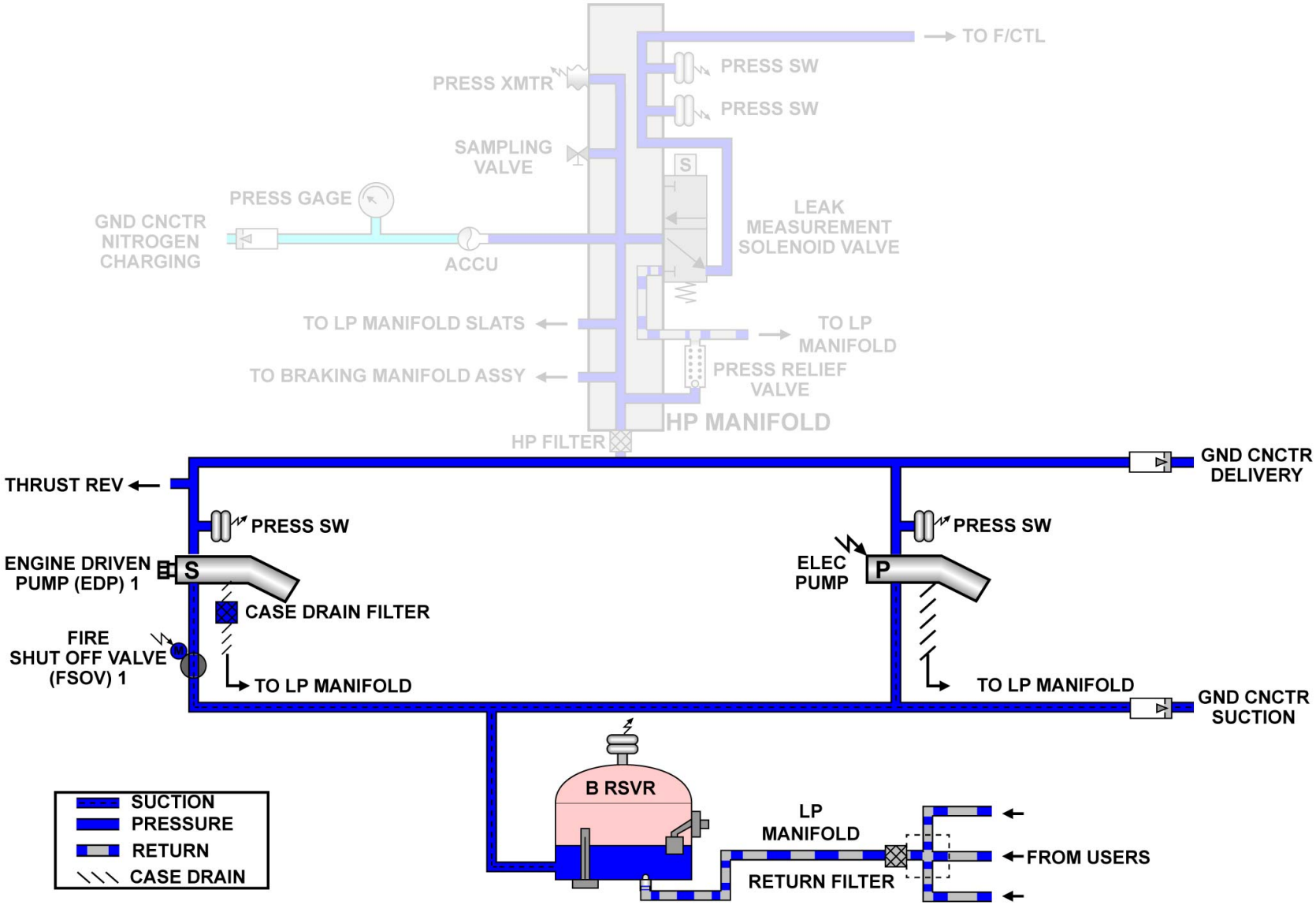
GROUND CONNECTORS

For maintenance purposes, ground self-sealing connectors are installed on the service panel.

RETURN FILTER

The LP return filter is of the bypassing type, with a clogging indicator set to operate at 73 psi.

G9409341 - GAUT0T0 - FM29D2000000003



SYSTEM DESCRIPTION - RESERVOIR ... RETURN FILTER

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

ACCUMULATOR

The power accumulator dampens the pump delivery pulsations and any pressure surges, and compensates for pump response time in the event of high flow demand. It is installed in vertical position and has two ports: a GAS port at the upper end and a FLUID port at the lower end. The GAS port is connected via a pipe to a nitrogen charging ground connector and to a direct-reading pressure gage which are installed on the blue service panel.

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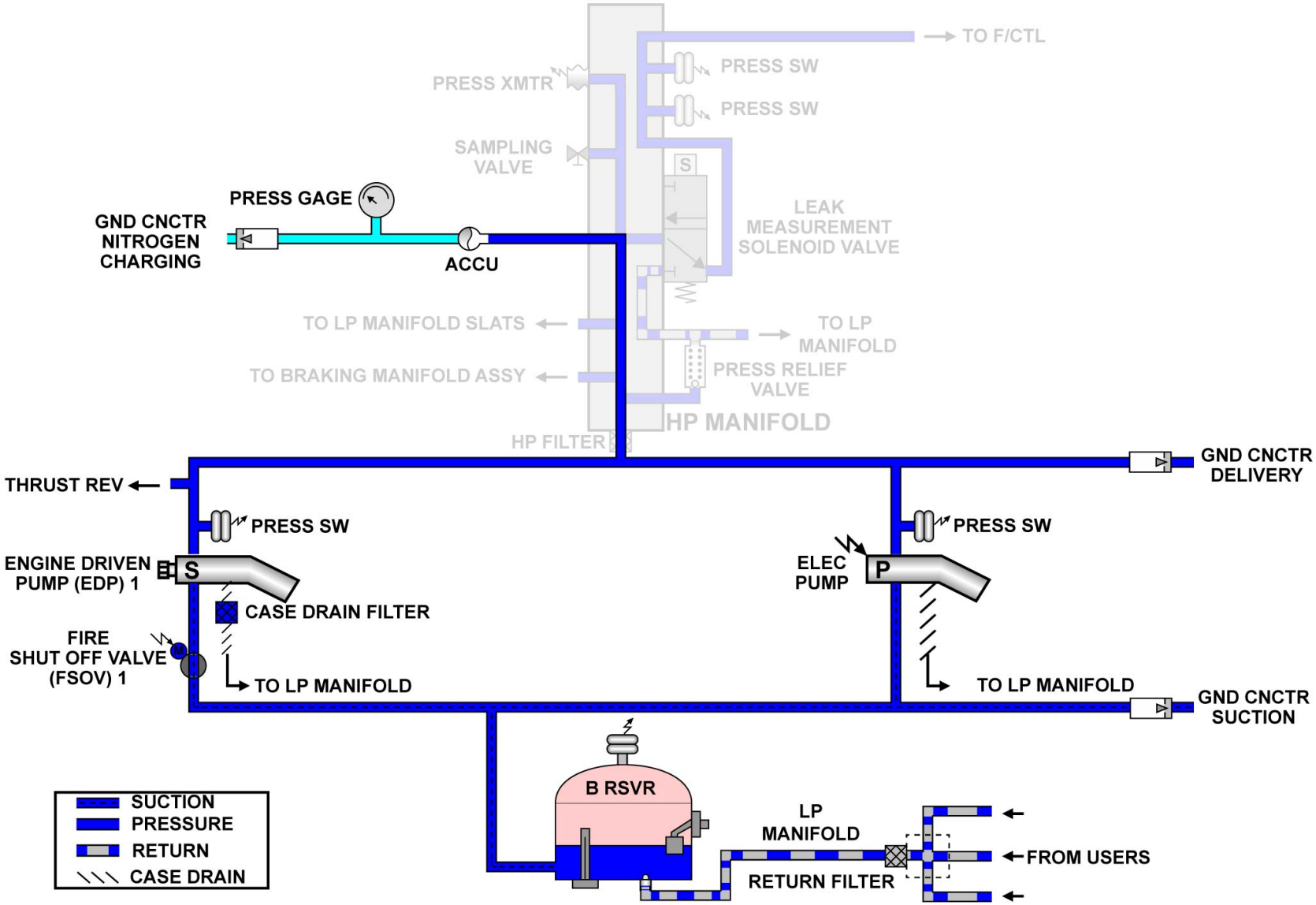


SYSTEM DESCRIPTION - ACCUMULATOR

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

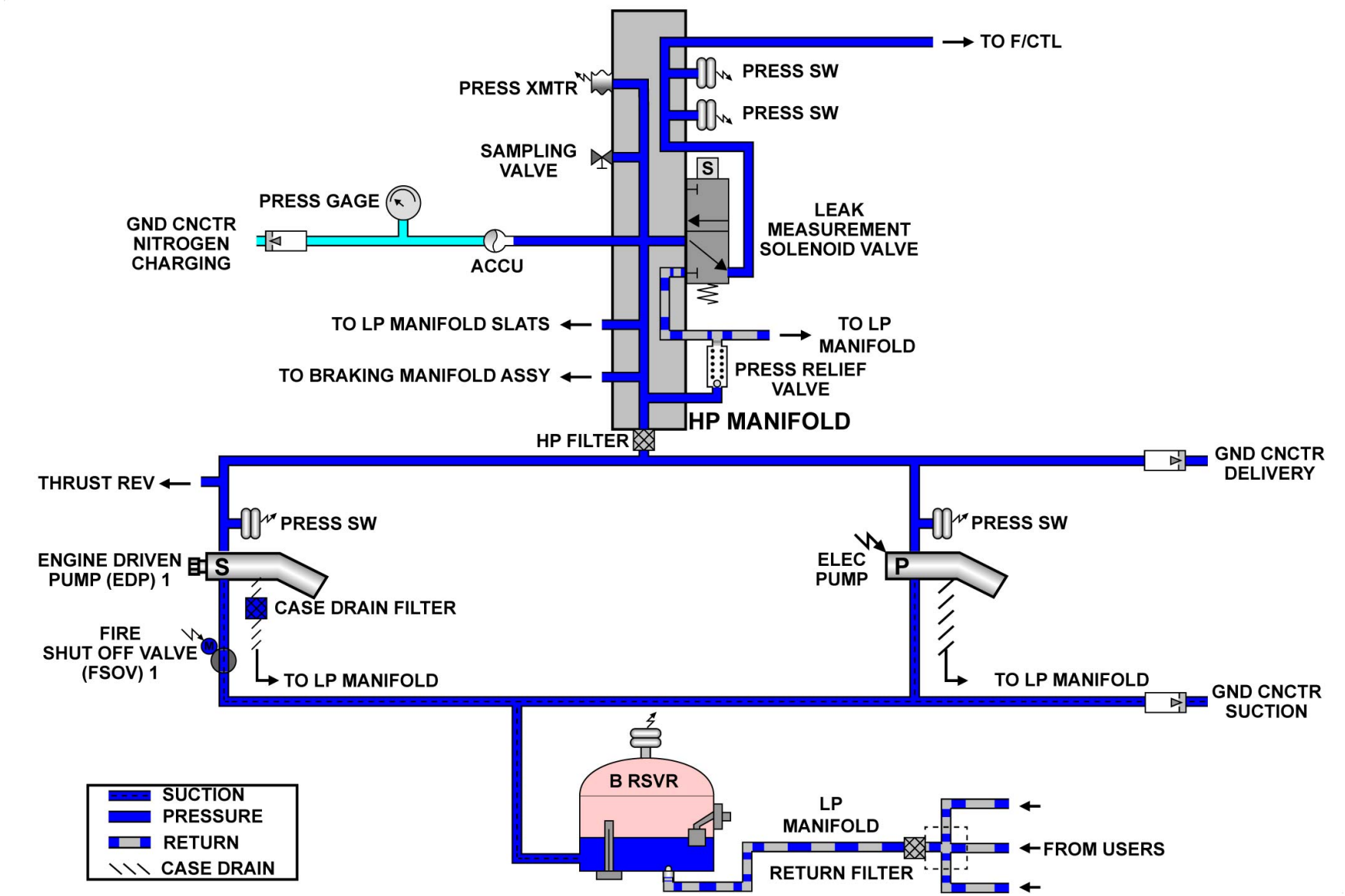
SYSTEM DESCRIPTION (continued)

HP MANIFOLD

The High Pressure (HP) filter is of the non-bypassing type, with a clogging indicator set to operate at 87 psi. A clogging indicator is installed on each filter. A pressure relief valve returns the fluid directly to the reservoir in overpressure condition. A leak measurement solenoid valve can be selected shut to isolate the supply to the flight controls, when the A/C is on the ground.
A pressure transmitter and two pressure switches give pressure information to the ECAM and flight control computers. The sampling valve is used to take samples of hydraulic fluid to look for contamination.

CAUTION: When sampling, let the fluid run for a moment into a container, then put 0.2L (0.05US Gal) of fluid into an appropriate bottle for analysis.

G9409341 - GAUT0T0 - FM29D2000000003



SYSTEM DESCRIPTION - HP MANIFOLD

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

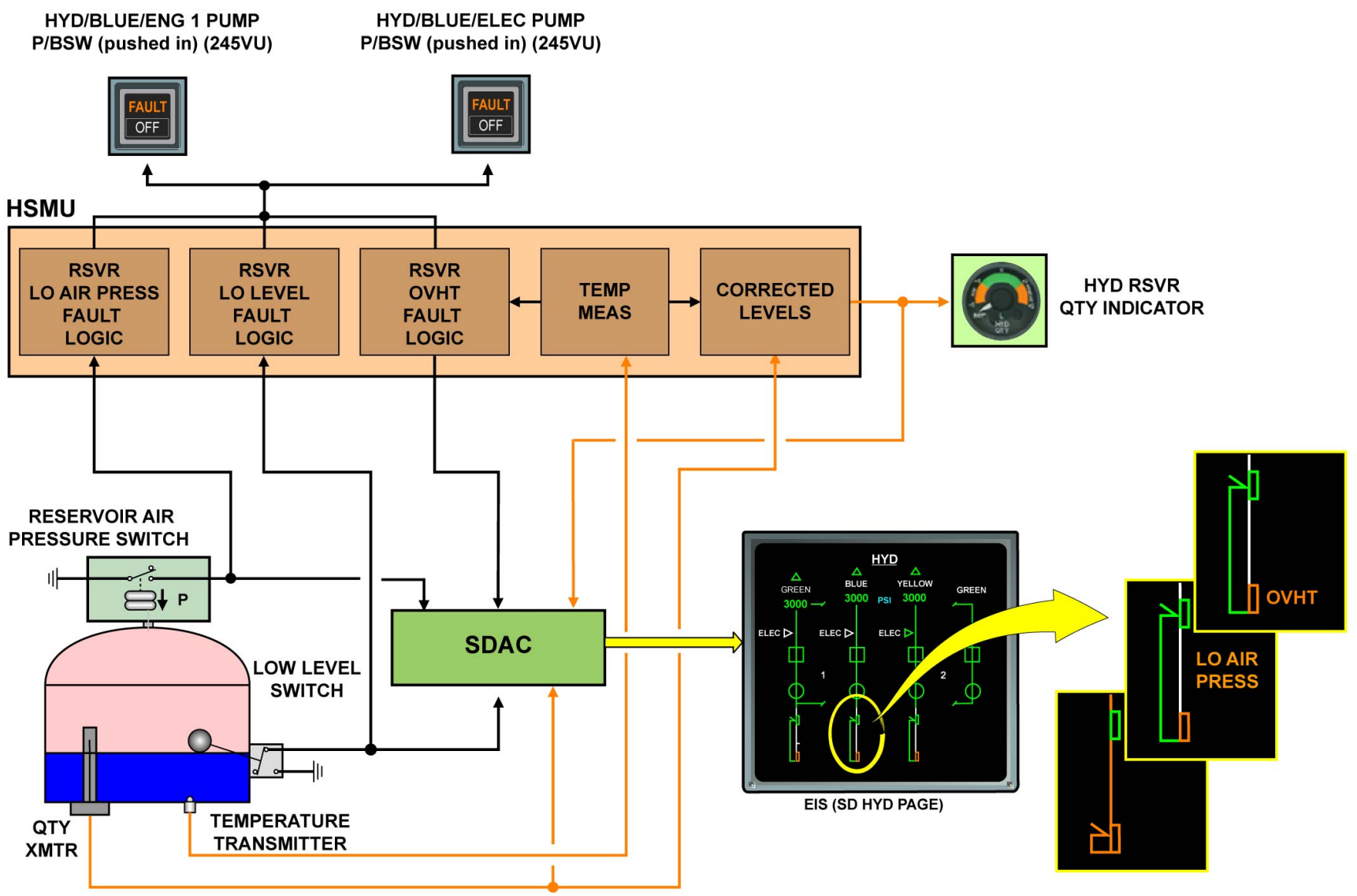
RESERVOIR

The air pressure switch sends a discrete signal to the HSMU and System Data Acquisition Concentrators (SDACs). When the air pressure in the reservoir decreases to 22 psi, the contact opens. The HSMU uses this signal to elaborate its internal logics and controls the FAULT legend(s) on the P/BSW on the HYD section of the overhead panel. The same signal is used by the SDACs for ECAM indication and associated warning. When the air pressure increases to 25 psi, the contact closes, the FAULT legend(s) goes off.
A quantity transmitter elaborates a 1 to 9 V analog signal which agrees with to the level of fluid in the reservoir. When a low level is detected, the low level switch sends a discrete signal to the HSMU and SDACs. The HSMU uses this signal to elaborate its internal logics and controls the FAULT legend(s) on the P/BSW on the HYD section of the overhead panel. The same signal is used by the SDACs for the ECAM indication and associated warning.
The temperature transmitter sends its analog information to the HSMU. The computer converts the received signal into a voltage, which is between 1 V to 9 V. This signal is used for temperature compensation of the ECAM fluid level fill band, and overheat detection. (1 V related to -60ºC , 9 V related to +120ºC). When a temperature of a system reaches 95ºC, the HSMU gives an overheat signal and triggers the FAULT legend related to the engine pumps and to the electric pump. A copy of this overheat signal is also sent to the SDACs for the ECAM indication and associated warning.

NOTE: Note: The amber OVHT message stays on as long as the sensor detects the overheat.

From the fluid temperature and level gage signals, the HSMU elaborates a 1 to 9 V analog signal, which agrees with the reservoir filling correction to make. These signals are sent to the filling correction indicator located on the green ground service panel, via the filling selector valve.

G9409341 - GAUT0T0 - FM29D2000000003



RESERVOIR

G9409341 - GAUT0T0 - FM29D2000000003

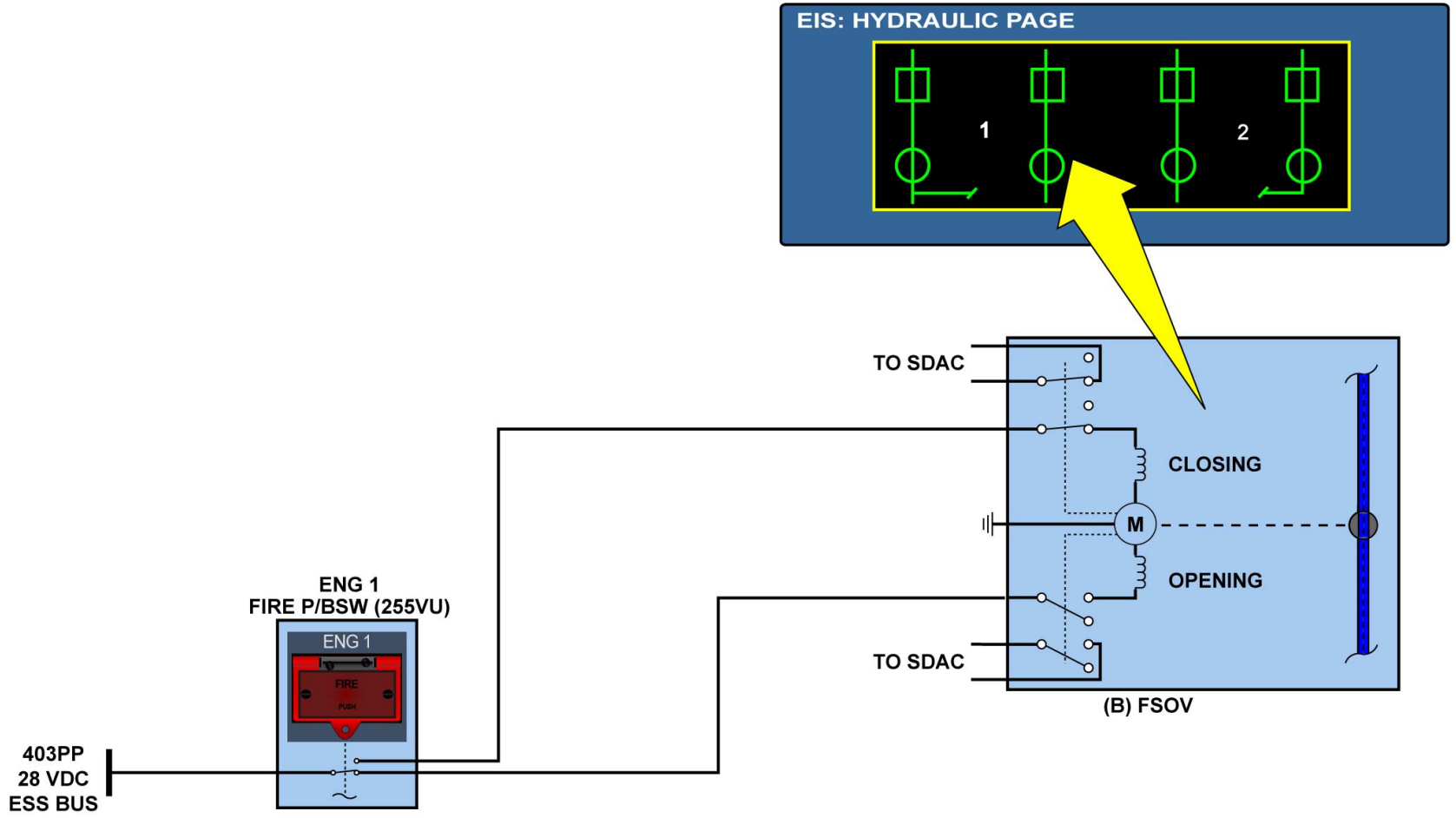
BLUE HYDRAULIC SYSTEM D/O (3)

FIRE SOV LOGIC OPERATION

The engine 1 fire SOV is supplied with 28 VDC from the ESS BUS. In case of an engine fire, the crew closes the engine 1 fire SOV.

G9409341 - GAUT0T0 - FM29D2000000003

FSOV LOGIC



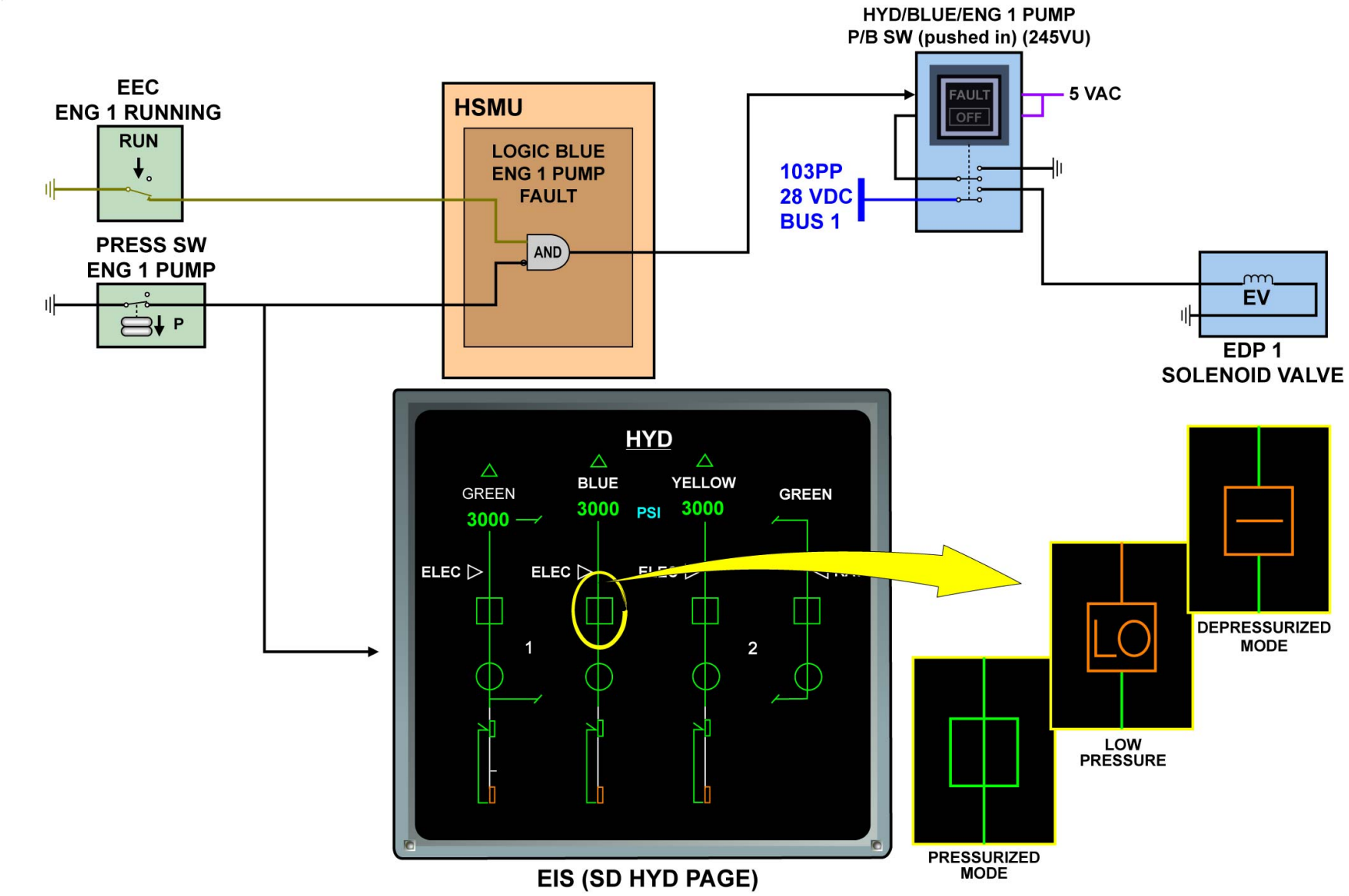
FIRE SOV LOGIC OPERATION

BLUE HYDRAULIC SYSTEM D/O (3)

EDP LOGIC OPERATION

As soon as engine 1 is running, the pump pressurizes the system to 3000 psi. A pressure switch monitors the output of each pump. If the pressure drops below 1750 psi, while the engine is running, the HSMU illuminates the FAULT indication on the engine P/BSW. The pressure switch also sends a signal to the SDAC for the ECAM indication and related warnings for a pump LP. The fault indication is inhibited when there is no signal from the Engine Electronic Controller (EEC). When the blue engine 1 pump P/BSW is set to OFF, the depressurization solenoid valve of the related pump is energized and the pump no longer supplies fluid. In this case, the related OFF legend comes on.

G9409341 - GAUT0T0 - FM29D2000000003



EDP LOGIC OPERATION

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION

STAND-BY (PUMP OFF)

GENERAL:
The control of the blue electric pump operation relies on the P/BSW 4JC, 6JC, the HSMU and a RCCB (Remote Control Circuit Breaker). The motor of the blue electric pump is supplied from the 2XP3 bus (115VAC triphase) through the RCCB. The blue electric pump can be controlled either manually from the P/BSW 6JC or automatically by the HSMU.
STAND-BY CONFIGURATION:
In stand-by configuration the 28VDC electric pump control loop (4JC / 6JC / HSMU / RCCB) is open; the coil of the RCCB is de-energized; the RCCB is open; the electric pump motor is not supplied; the pump is stopped.

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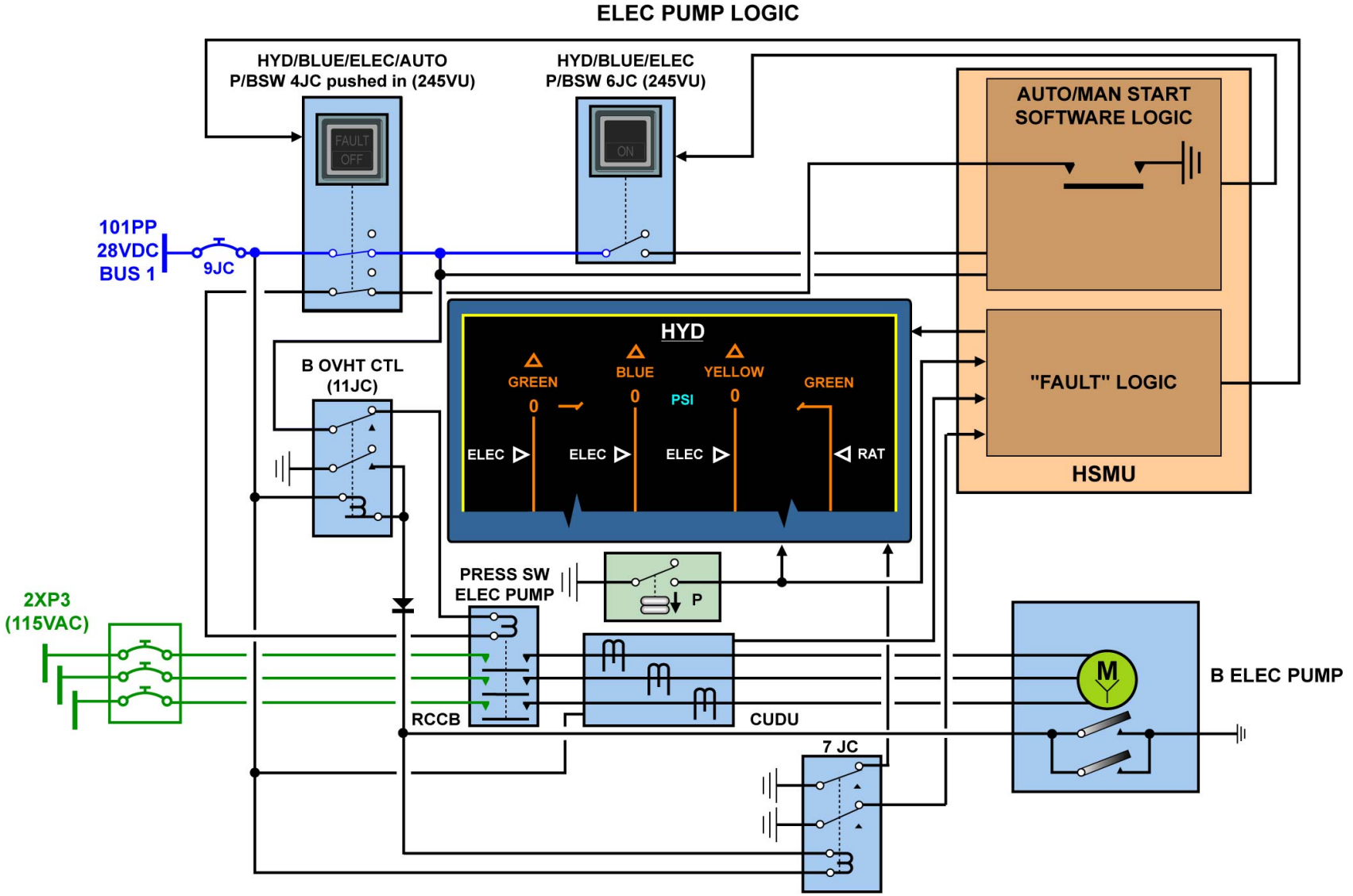

ELECTRIC PUMP LOGIC OPERATION - STAND-BY (PUMP OFF)

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION (continued)

PUMP START

MANUAL START:
By pressing the 6JC pulse P/BSW the HSMU gets a +28 VDC signal. Getting this signal, by software logic, the HSMU closes the electrical pump control loop. The RCCB coil is energized; the RCCB closes; the electric pump motor is supplied by the 115 VAC; the pump starts running.
The HSMU also controls the illumination of the cyan ON legend on the 6JC pulse P/BSW.

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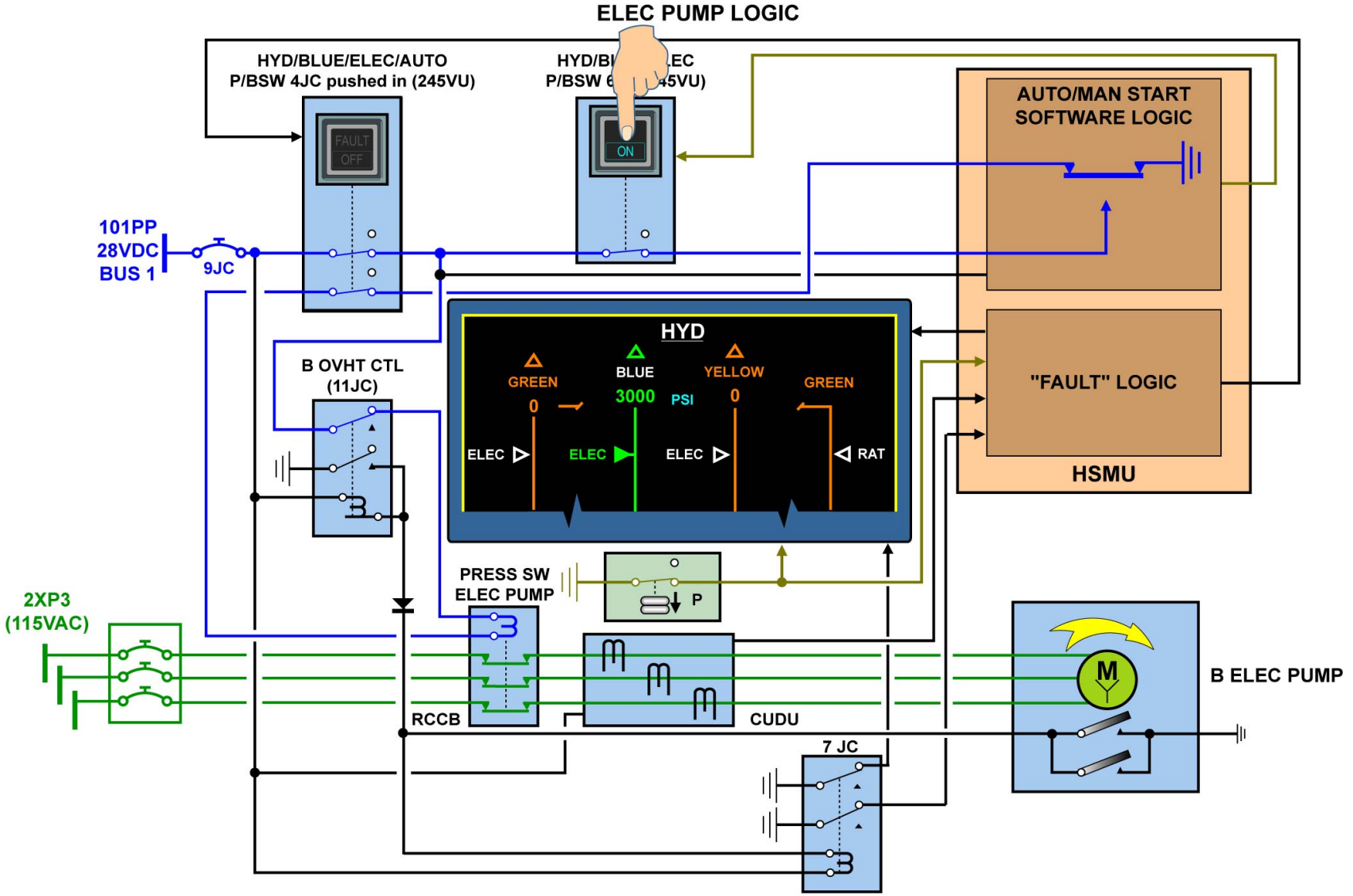

ELECTRIC PUMP LOGIC OPERATION - PUMP START

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION (continued)

PUMP RUNNING

PUMP RUNNING:
When the 6JC pulse P/BSW is released the HSMU does not get any longer the +28VDC signal but, by software logic, keeps the electric pump control loop closed. The RCCB is kept energized closed; the electric pump keeps running; the cyan "ON" legend is kept illuminated by the HSMU.
MANUAL STOP:
By pressing again the 6JC pulse P/BSW while the electric pump is running the HSMU gets a new + 28 VDC signal. Getting this new signal, by software logic, the HSMU opens the electric pump control loop; the RCCB coil is de-energized; the RCCB opens; the electrical pump motor is no longer supplied by the 115 VAC; the pump stops running.
The HSMU also controls the cyan "ON" legend on the 6JC pulse P/BSW to extinguish.
AUTOMATIC CONTROL:
The blue electric pump can be controlled automatically by the HSMU. The control logic is as follows:
Aircraft in flight (input from LGCIU) and airspeed above 100 kts (input from ADIRU) AND engine 1 failed (HP compressor below 50 % input from EIVMU) AND FCPC 1 OR 3 inoperative/OFF (input from FCPC 2) AND flap/slat lever not in zero position (input from SFCC) => blue electric pump starts running.
The purpose of this logic is to provide the rudder surface with sufficient hydraulic power to reach the deflection needed to counteract the sideslip induced by the engine asymmetric thrust at low airspeed. Refer to the ATA 27 YAW presentation module for further information.

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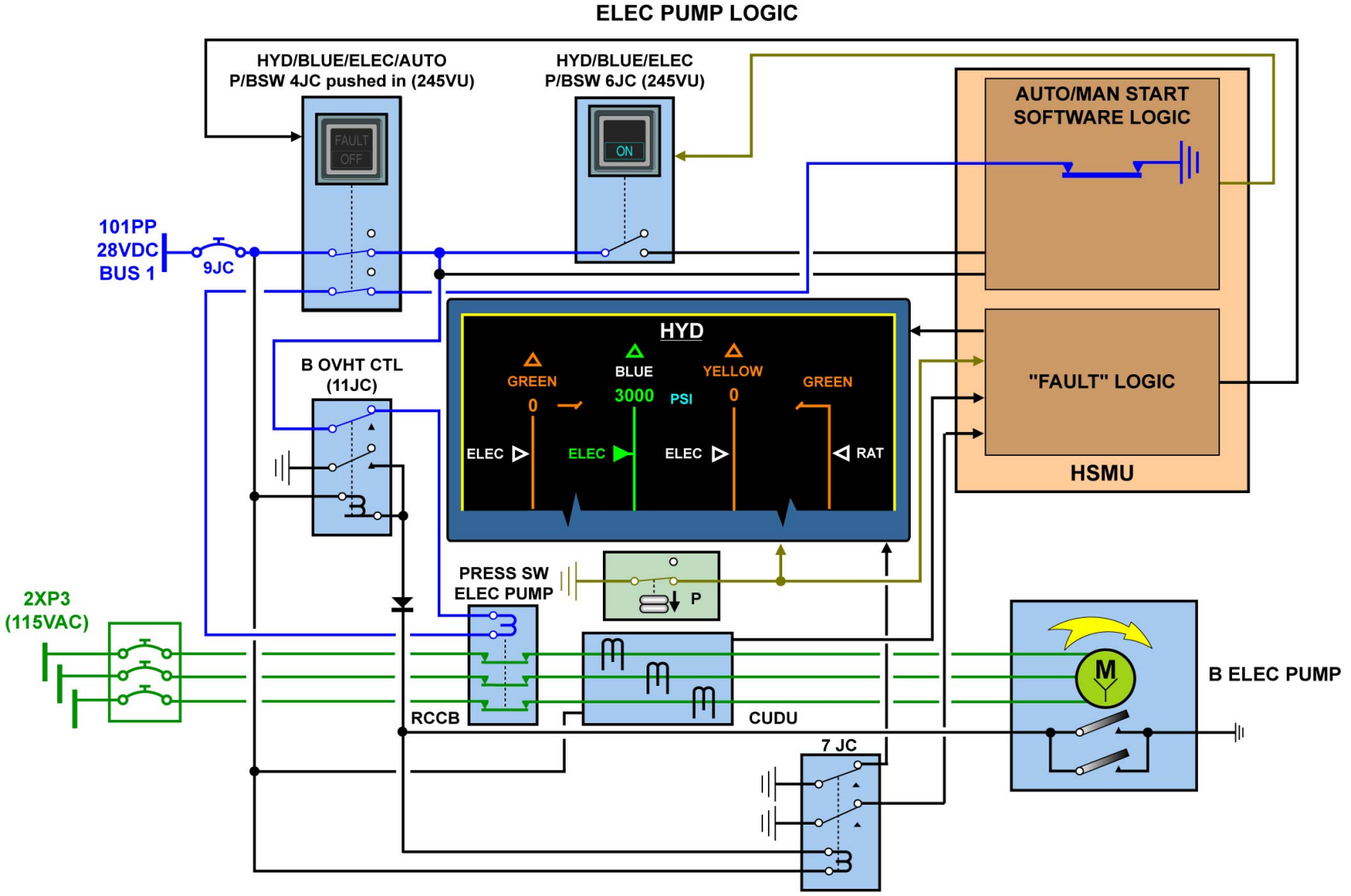

ELECTRIC PUMP LOGIC OPERATION - PUMP RUNNING

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION (continued)

PUMP LOW PRESSURE

LOW PRESSURE:

The blue electric pump delivers hydraulic pressure. A pressure switch connected to the pressure line downstream of the pump monitors the hydraulic pressure.

During normal operation of the electric pump this pressure switch is closed sending to both, the EIS and the HSMU a ground signal.

If the delivered pressure drops below 1450 psi, the pressure switch opens; the ground signal from the pressure switch is lost by the EIS and the HSMU; the electric pump is displayed amber on the ECAM hydraulic system page by the EIS; the HSMU controls the amber FAULT legend on the 4JC P/BSW to illuminate.

These indications are inhibited if the electric pump is not commanded to run.

Note: The electric pump is not stopped automatically in case of low pressure being detected by the pressure switch. If it is stopped manually by releasing-out the 4JC P/BSW, the amber FAULT legend is extinguished by the HSMU, the white OFF legend illuminates, on the 4JC P/BSW and the cyan ON legend is extinguished on the 6JC P/BSW.

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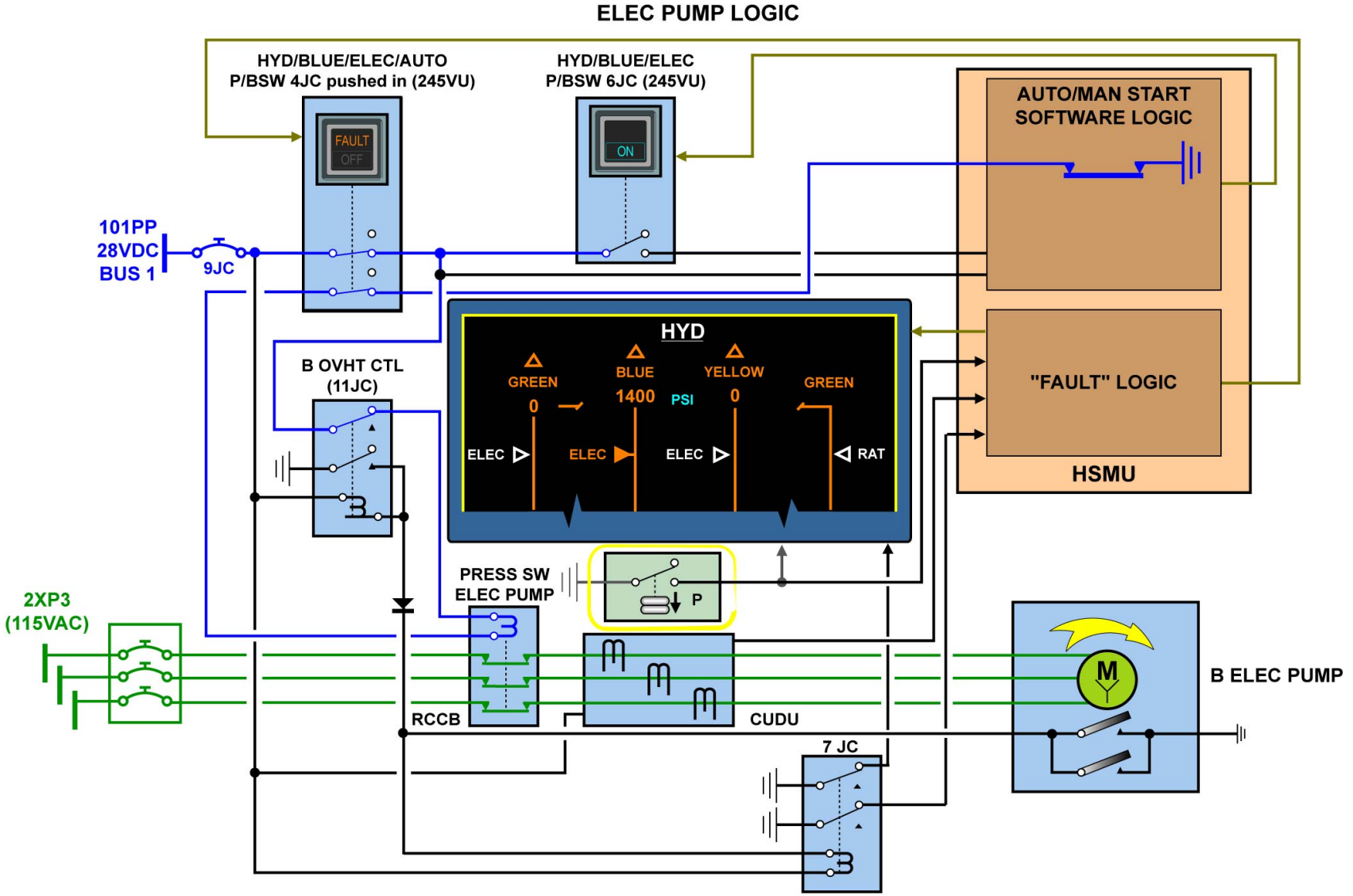


ELECTRIC PUMP LOGIC OPERATION - PUMP LOW PRESSURE

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION (continued)

PUMP OVERHEAT

OVERHEAT:

In the event of a blue electric pump motor overheating, the electric pump stops automatically; related indications are displayed; electric pump further operation is inhibited (even after cool down); reset is only possible on the ground.

The above logic is independent from the HSMU software, it is performed by a dedicated external circuit including three components: a thermal switch installed in the motor of the electric pump, a self-holding type relay (B OVHT CTL 11JC) and an indication relay (7JC).

If the temperature of the electric pump motor reaches 230 deg.C (446 deg.F) the thermal switch closes; a ground is supplied to the coil of the relays 11JC and 7JC; both relays 11JC and 7JC are getting energized, they both open.

The opening of the relay 11JC causes the opening of the electric pump control loop; the RCCB coil is no longer energized, the RCCB opens; the motor of the electric pump is no longer supplied by the 115VAC; the electric pump stops running.

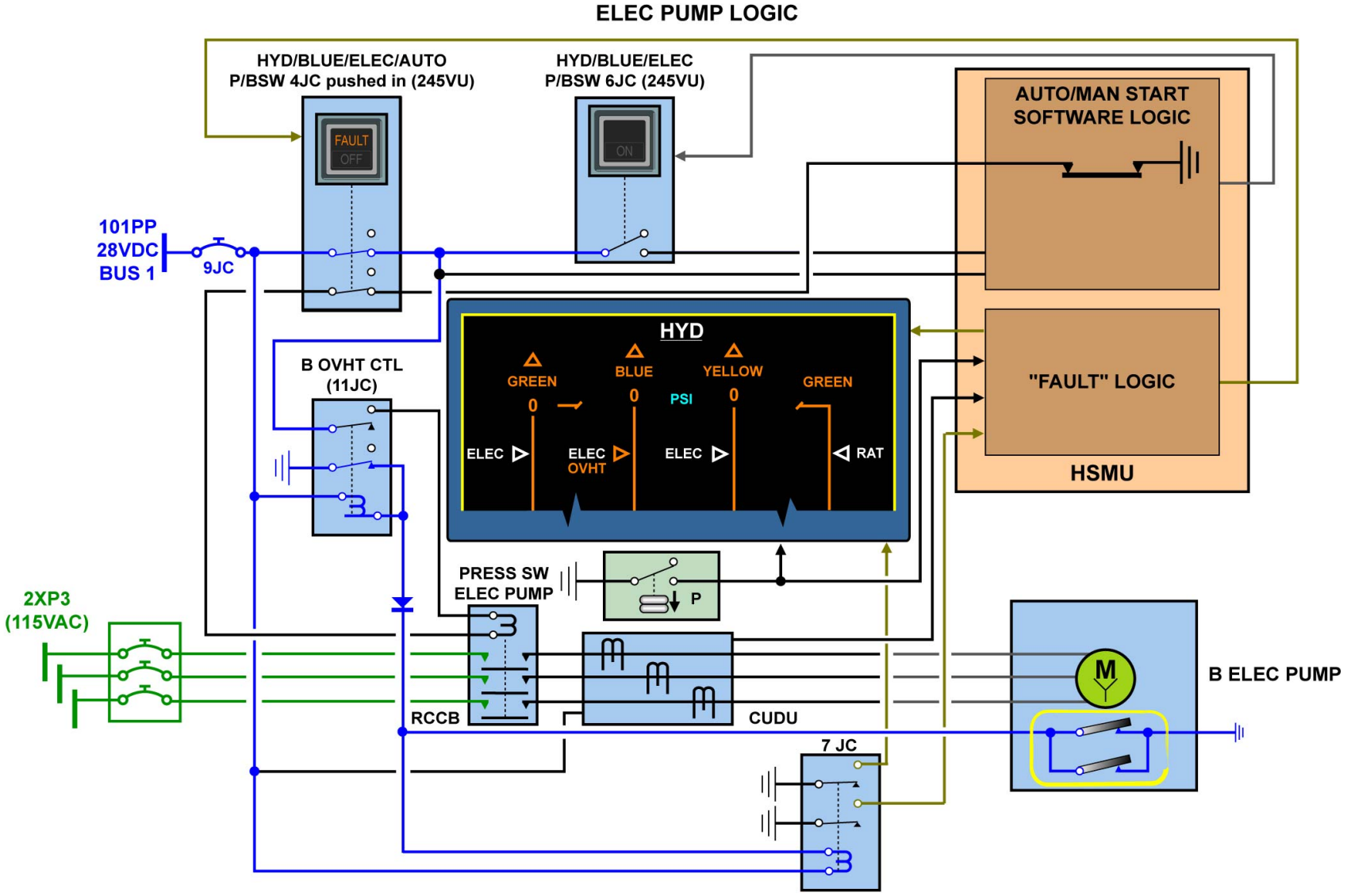
With the opening of the relay 7JC the ground signals received by the EIS and the HSMU are both lost; the EIS displays the electric pump in amber with the amber OVHT legend on the ECAM hydraulic system page; the amber FAULT legend is illuminated by the HSMU on the 4JC P/BSW. The cyan ON legend on the 6JC P/BSW is extinguished by the HSMU.

Note: If the 4JC P/BSW is released-out (as per ECAM procedure) the OFF white legend illuminates, but the amber FAULT legend is not extinguished by the HSMU.

When the temperature of the electric pump motor drops below the overheat threshold the thermal switch re-opens but the relay 11JC remains energized open (self-holding); the electric pump control loop is latched open making impossible any further start of the pump.

On the ground, reset of the 9JC C/B (not accessible in flight) makes possible to recover the control of the electric pump. Opening the 9JCC/B de-energizes the coil of the relay 11JC; the relay 11JC is unlatched and closes. After the 9 JC C/B has been closed the control loop of the electric pump is restored to the stand-by configuration.

G9409341 - GAUT0T0 - FM29D2000000003



ELECTRIC PUMP LOGIC OPERATION - PUMP OVERHEAT

G9409341 - GAUT0T0 - FM29D2000000003

BLUE HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP LOGIC OPERATION (continued)

CURRENT UNBALANCE

UNBALANCE:

The 115 VAC triphase power supply of the electric pump is monitored by the CUDU (Current Unbalance Detection Unit). This component, based on the Hall effect sensor principle, measures and compares the electric currents of each individual phase of the electric pump power supply.

During normal operation of the electric pump, the currents of each individual phase are balanced.

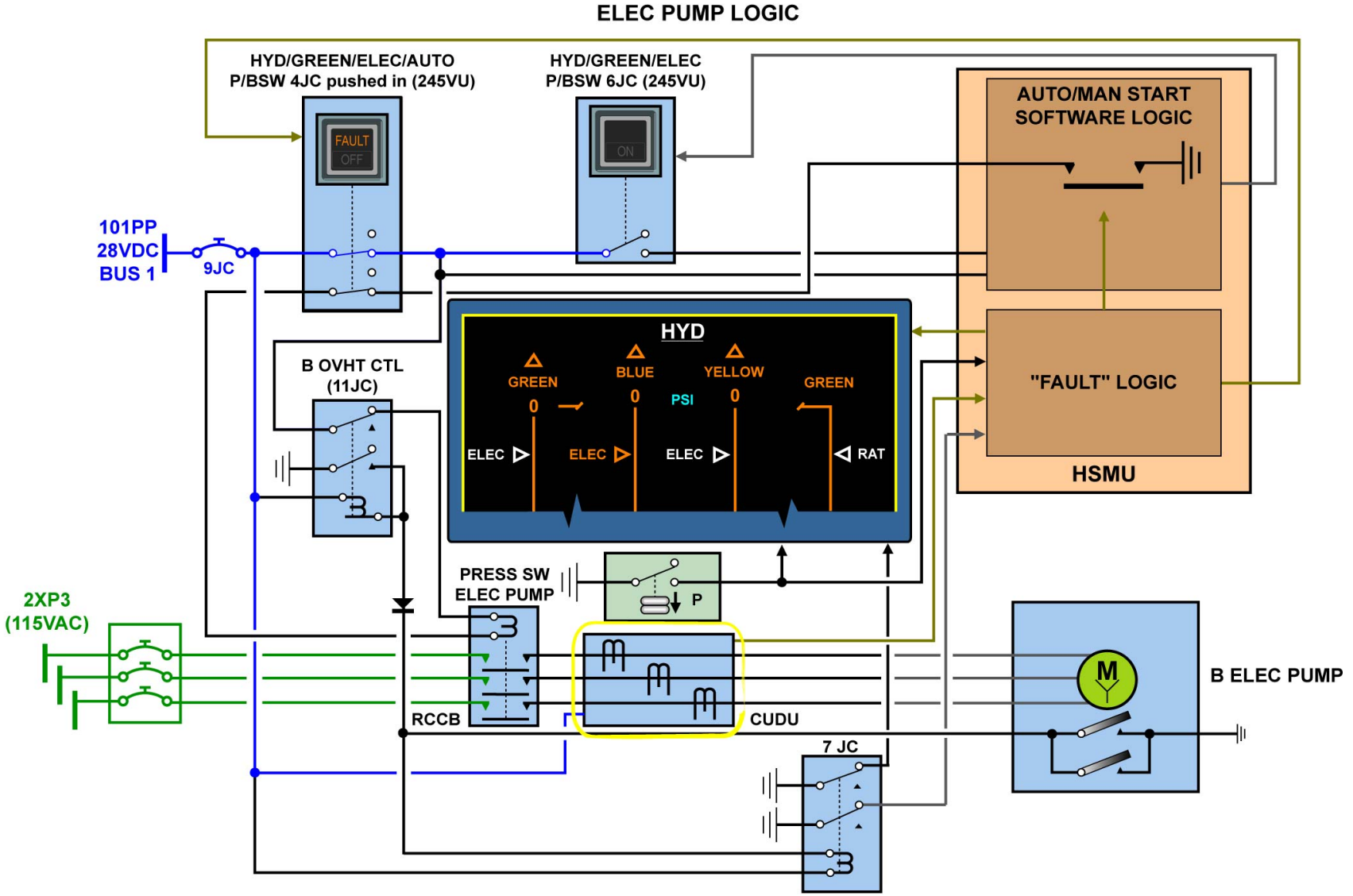
In the event of a current unbalance between at least two phases, the CUDU signals the fault to the HSMU which, by software logic, opens the electric pump control loop; the RCCB is de-energized; the motor of the electric pump is no longer supplied; the electric pump stops running.

The fault signal sent to the HSMU is latched by the CUDU making it impossible any further start of the electric pump. To recover control of the electric pump the CUDU has to be de-powered / re-powered; this can be carried-out on the ground by a reset of the 9JC C/B.

In addition to the automatic stop of the pump, the HSMU also controls the amber FAULT legend to illuminate, on the 4JC P/BSW and the cyan ON legend to extinguish on the 6JC P/BSW.

Thanks to a test push-button on the CUDU, current unbalance condition can be simulated and automatic shut-down of the electric pump checked during maintenance.

G9409341 - GAUT0T0 - FM29D2000000003



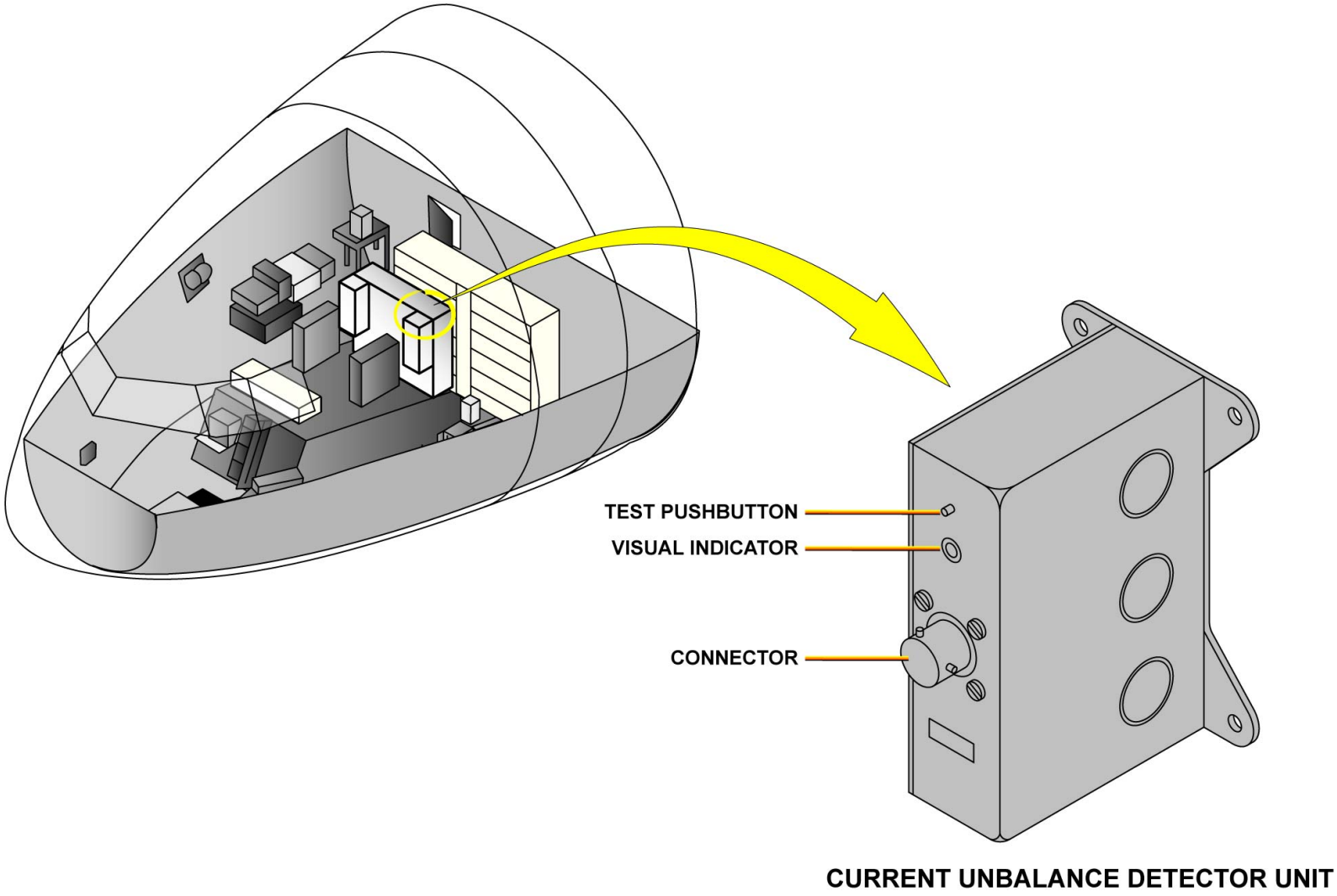
ELECTRIC PUMP LOGIC OPERATION - CURRENT UNBALANCE

BLUE HYDRAULIC SYSTEM D/O (3)

CURRENT UNBALANCE DETECTOR UNITS (CUDU)

The CUDUs monitor the supply current of the electric pumps. They detect a current unbalance or the cut-off of one or two phases in the three phases power supply of the electric pumps. They send, to the HSMU, a signal to cut-off the power supply of the contactors related to the electric pumps when they detect an unbalance between the three phases. Switching off the power supply of the current unbalance detector units launches the reset.
A test pushbutton associated to an annunciator light comes on when the test has been done and the CUDU operates properly.

G9409341 - GAUT0T0 - FM29D2000000003



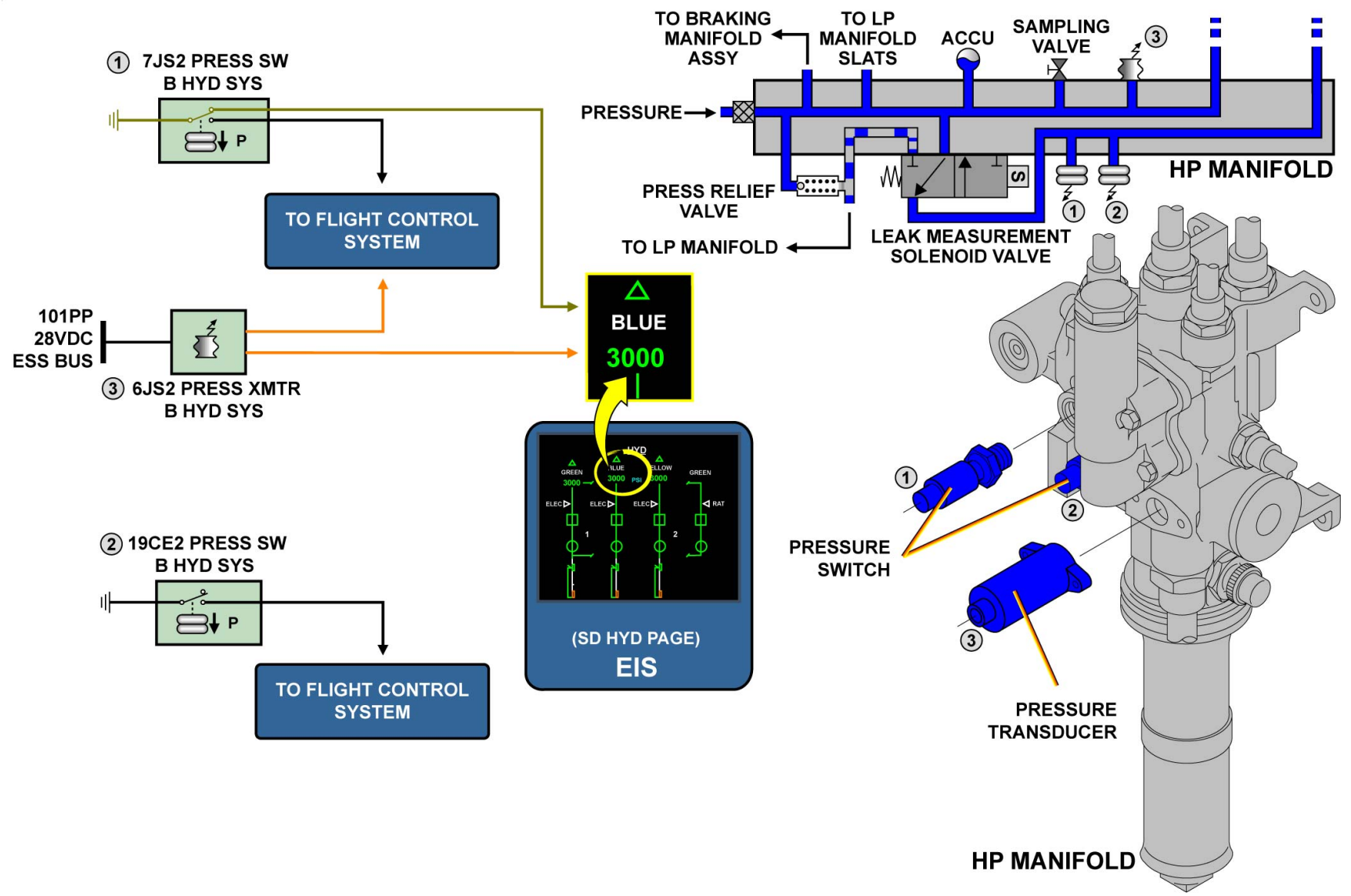
CURRENT UNBALANCE DETECTOR UNITS (CUDU)

BLUE HYDRAULIC SYSTEM D/O (3)

DISTRIBUTION INDICATIONS

The pressure transmitter (6JS2) sends an analog signal which is used to give the hydraulic system pressure indication on the hydraulic SD system page. This same signal is also sent to the flight control system in order to give the pressure indication. The leak measurement solenoid valve is normally de-energized open. Selecting OFF, at the maintenance panel, will energize the valve to close off the supply to the flight control system. The solenoid power supply is inhibited in flight above 100 Kts using information from Air Data/Inertial Reference Units (ADIRUs) 1 & 3 and Landing Gear Control and Interface Units (LGCIUs).
The pressure switch (7JS2) sends a discrete signal, if the pressure is less than 1450 psi. This signal is used for ECAM indication on the hydraulic page and for warning messages. This signal is also used by the flight control system. The pressure switch (19CE2) only gives pressure information to the flight control system. The ground service manifold is used during the ground leak test, to selectively enable the hydraulic supply to the flight controls when the leak measurement valve is closed.

G9409341 - GAUT0T0 - FM29D2000000003



DISTRIBUTION INDICATIONS

G9409341 - GAUT0T0 - FM29D2000000003

YELLOW HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION

The yellow hydraulic system is pressurized via different components which will be described.

RESERVOIR

The reservoir is air-pressurized to 50 psi (in flight or on ground) in order to avoid cavitation of the hydraulic pumps. It is designed to remain pressurized for at least 12 hours. On the top of each reservoir, an air pressure switch monitors the air pressure inside the reservoir. A low level switch installed in the middle of each reservoir monitors the fluid quantity to activate a low level caution at 5 l remaining. An analog system, based on capacitive transmitters, permanently monitors the fluid level. A temperature transmitter installed on the return port of the reservoir, sends fluid temperature indication to the Hydraulic System Monitoring Unit (HSMU).

FIRE SHUT OFF VALVE (FSOV)

The Fire Shut Off Valve (FSOV) is composed of a ball valve and an electric motor. They are located outside the engine fire zone. The motor section contains limit switches for control and monitoring.

ENGINE DRIVEN PUMP (EDP)

The two-stage Engine Driven Pump (EDP) is controlled by a solenoid valve.

CASE DRAIN FILTER

Each EDP has a case drain line and a filter, which is of the non-bypassing type. There is also a clogging indicator set to operate at 87 psi.

ELECTRIC PUMP

The two-stage electrical pump is controlled by the HSMU. It is monitored for overheat conditions and for phase unbalance detection through the Current Unbalance Detection Unit (CUDU).

GROUND CONNECTORS

For maintenance purposes, ground self-sealing connectors are installed on the service panel.

RETURN FILTER

The LP return filter is of the bypassing type. It has a clogging indicator set to operate at 73 psi.

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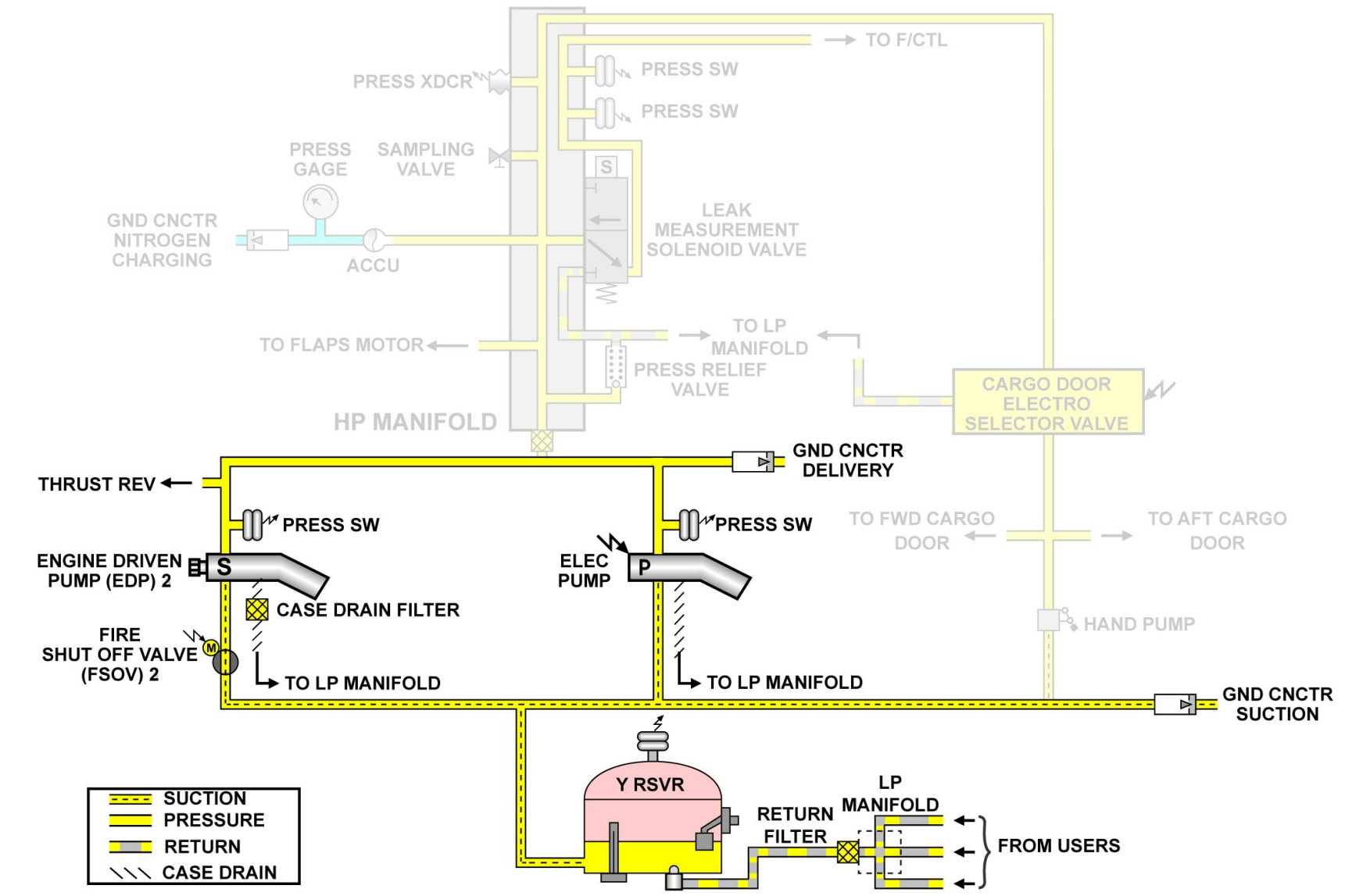

SYSTEM DESCRIPTION - RESERVOIR ... RETURN FILTER

G9409341 - GAUT0T0 - FM29D3000000003

YELLOW HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

ACCUMULATOR

The power accumulator damps the pump delivery pulsations and any pressure surges. It also compensates for pump response time in the event of high flow demand. It is installed in vertical position and has two ports, a gas port at the upper end and a fluid port at the lower end. The gas port is connected via a pipe to a nitrogen-charging ground connector and a direct-reading pressure gage located on the yellow service panel.

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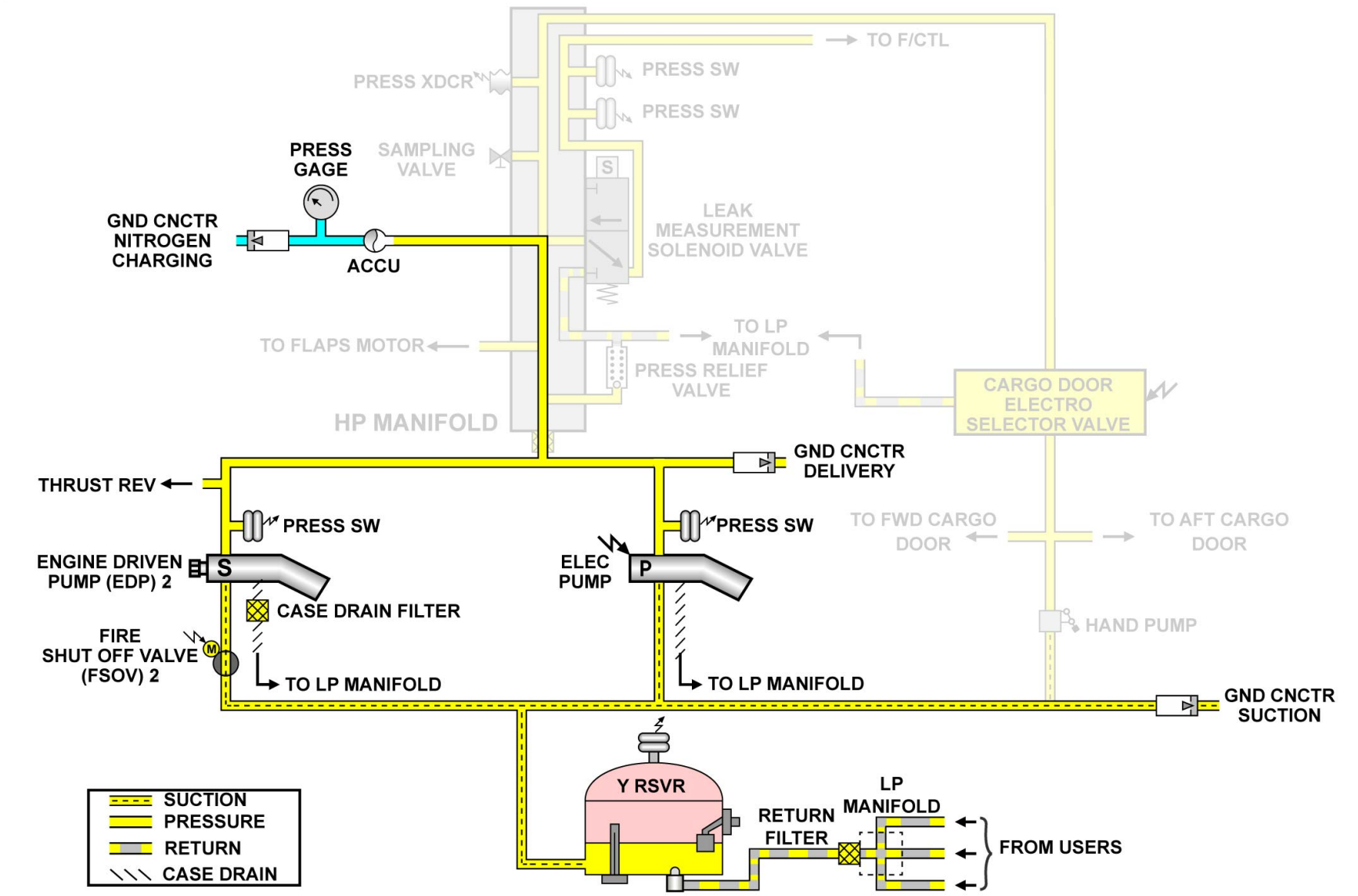

SYSTEM DESCRIPTION - ACCUMULATOR

G9409341 - GAUT0T0 - FM29D3000000003

YELLOW HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

HP MANIFOLD

The yellow HP manifold supplies the flight control users through the yellow ground service manifold. The yellow HP manifold includes various components. The HP filter is of the non-bypassing type with a clogging indicator set to operate at 87 psi. A pressure relief valve returns the fluid directly to the reservoir in overpressure condition. A leak measurement solenoid valve can be shut in order to isolate the supply to the flight controls, when the A/C is on ground. The sampling valve is used to take samples of hydraulic fluid to monitor for contamination. A pressure transducer and two pressure switches give pressure information to the ECAM and flight control computers.

CAUTION: When sampling, let the fluid run for a moment into a container, then put 0.2L (0.05USGal) of fluid into an appropriate bottle for analysis.

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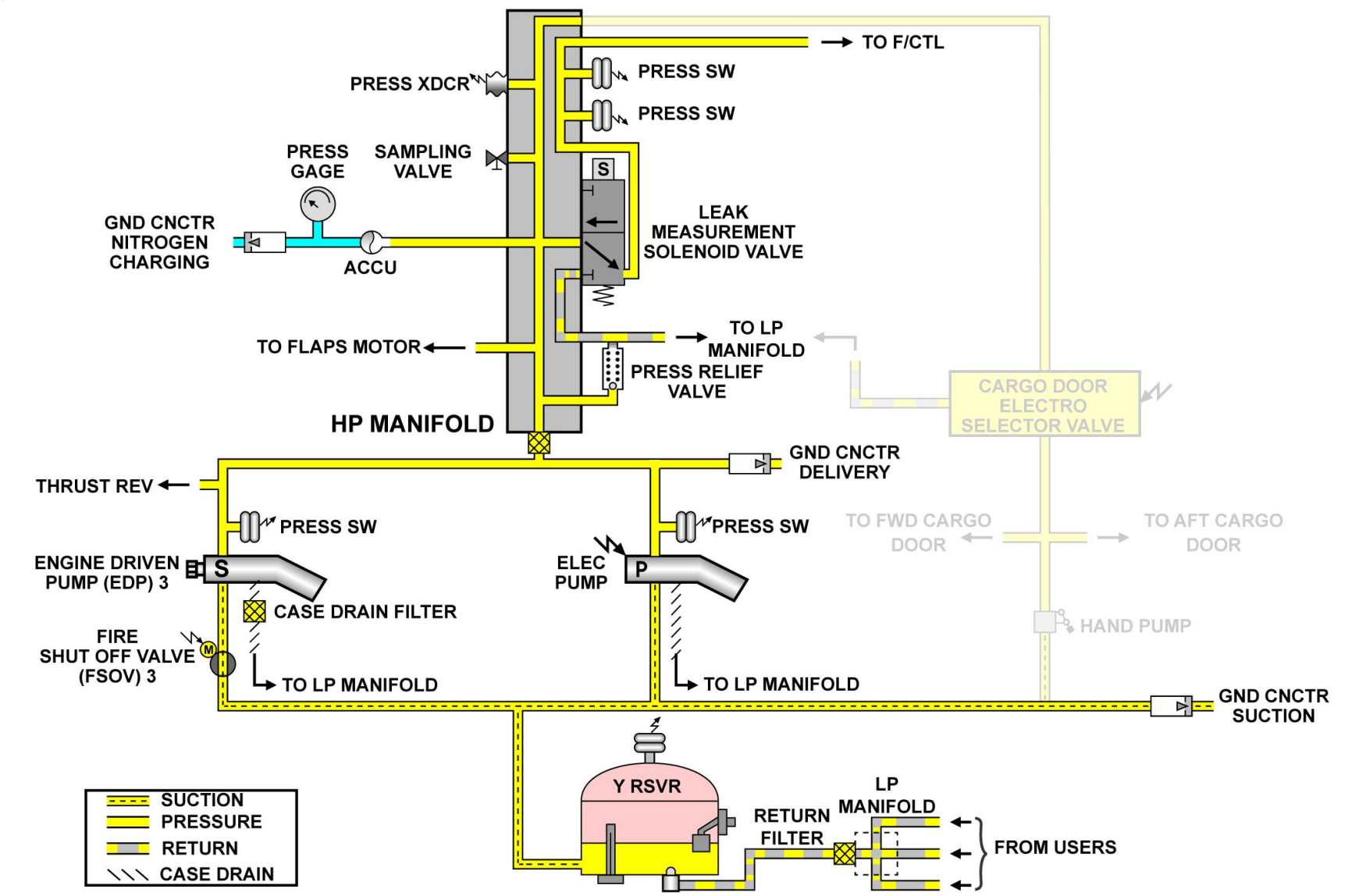

SYSTEM DESCRIPTION - HP MANIFOLD

G9409341 - GAUT0T0 - FM29D3000000003

YELLOW HYDRAULIC SYSTEM D/O (3)

SYSTEM DESCRIPTION (continued)

CARGO DOOR ELECTRO SELECTOR VALVE

The cargo door electro selector valve connects the yellow electric pump hydraulic supply to the cargo door system following a cargo door OPEN/SHUT selection.

HAND PUMP

The double-acting hand pump is only for cargo door operation. The handle is stowed on the green service panel.

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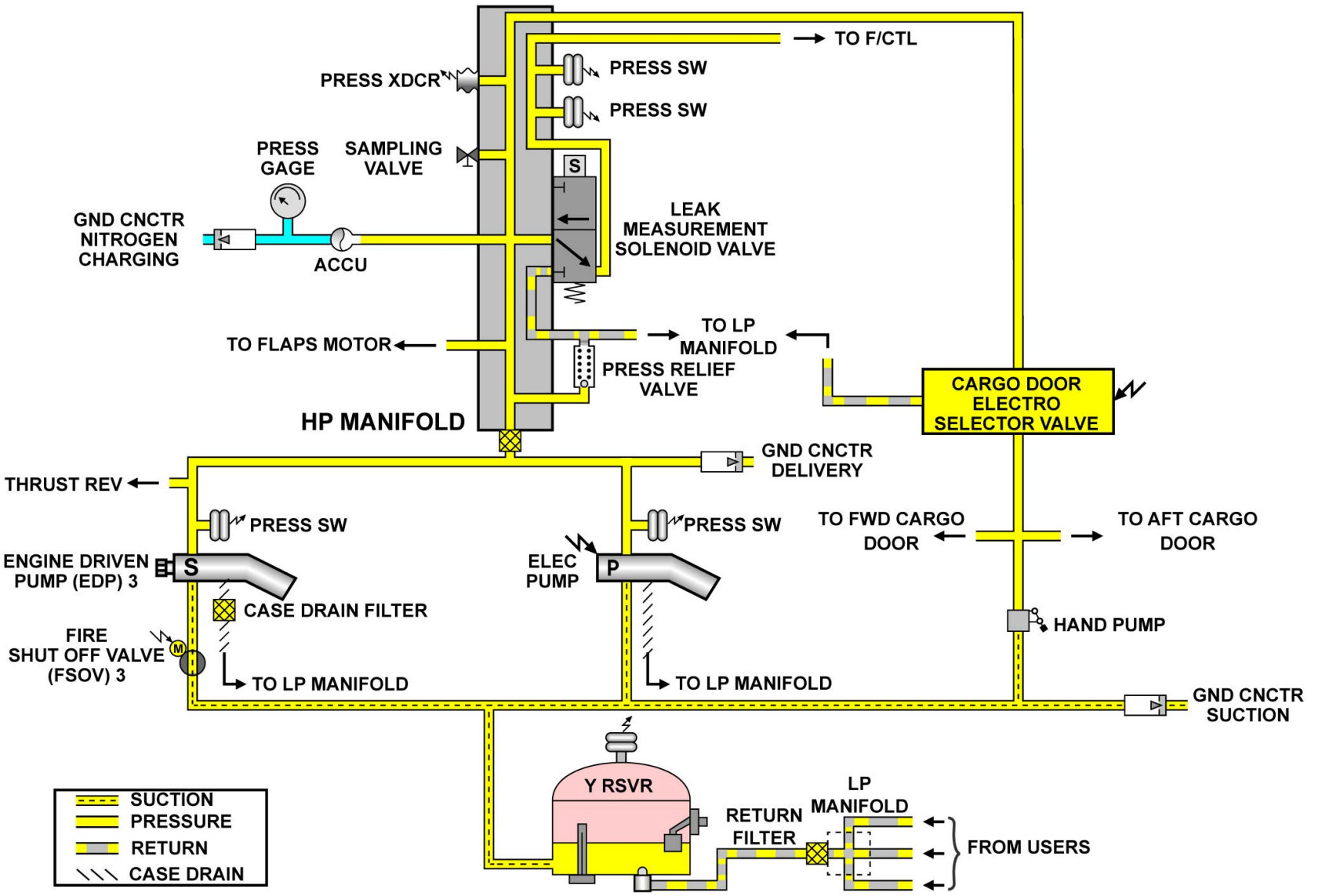

SYSTEM DESCRIPTION - CARGO DOOR ELECTRO SELECTOR VALVE & HAND PUMP

G9409341 - GAUT0T0 - FM29D3000000003

YELLOW HYDRAULIC SYSTEM D/O (3)

RESERVOIR

The air pressure switch sends a discrete signal to the HSMU and System Data Acquisition Concentrators (SDACs) when the air pressure in the reservoir drops below 22 psi. The HSMU uses this signal for its internal logic and controls the FAULT legends on the yellow HYD P/BSW. The same signal is used by the SDACs for ECAM indication and associated warning. When the air pressure rises above 25 psi, the FAULT legends go off.

A quantity transmitter elaborates a 1 to 9 V analog signal, which corresponds to the level of fluid in the reservoir. When a low level is detected, the low level switch sends a discrete signal to the HSMU and SDACs. The HSMU uses this signal for its internal logic and to control the FAULT legend on the yellow HYD P/BSW. The same signal is used by the SDACs for the ECAM indication and related warning.

The temperature transmitter sends its analog information to the HSMU. The computer converts the received signal into a voltage with a range from 1 to 9 V. This signal is used for temperature compensation of the ECAM fluid level fill band, and overheat detection. (1 V equals to -60ºC, 9 V equals to +120ºC).

When the fluid temperature reaches 95ºC, the HSMU generates an overheat signal and the FAULT legends comes on, on the yellow HYD P/BSW. A copy of this overheat signal is also sent to the SDACs for the ECAM indication and associated warning.

NOTE: Note: The amber OVHT message stays on as long as the sensor detects the overheat.

From the fluid temperature and level gage signals, the HSMU elaborates a 1 to 9 V analog signal, which agrees with the reservoir filling correction to make. These signals are sent to the filling correction indicator, located on the green ground service panel, via the filling selector valve.

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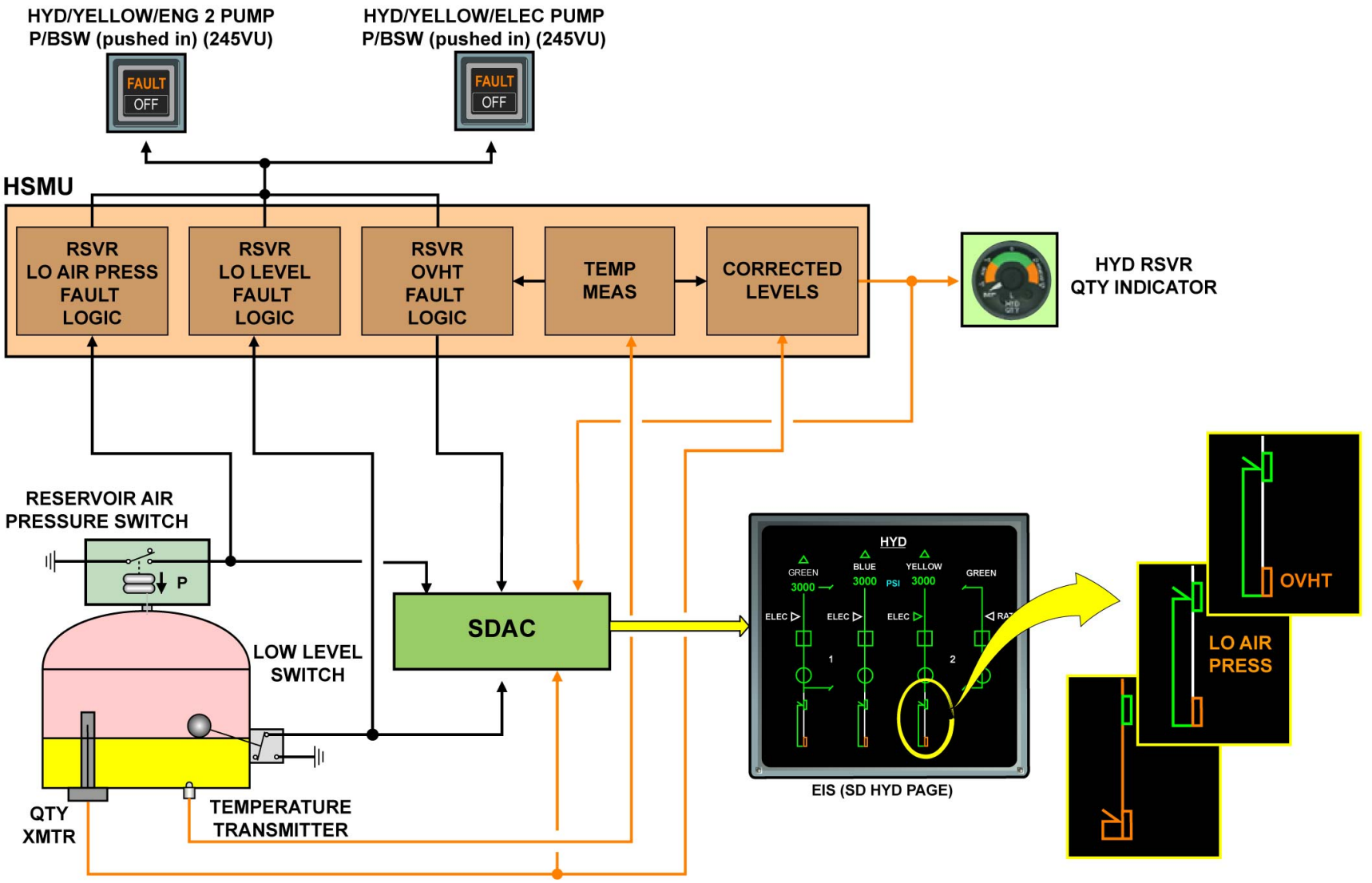

RESERVOIR

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YELLOW HYDRAULIC SYSTEM D/O (3)

FSOV OPERATION

The engine 2 FSOV is powered by 28 VDC either from BUS 2 or from the ESS BUS. In case of engine fire, the crew closes the engine 2 FSOV.

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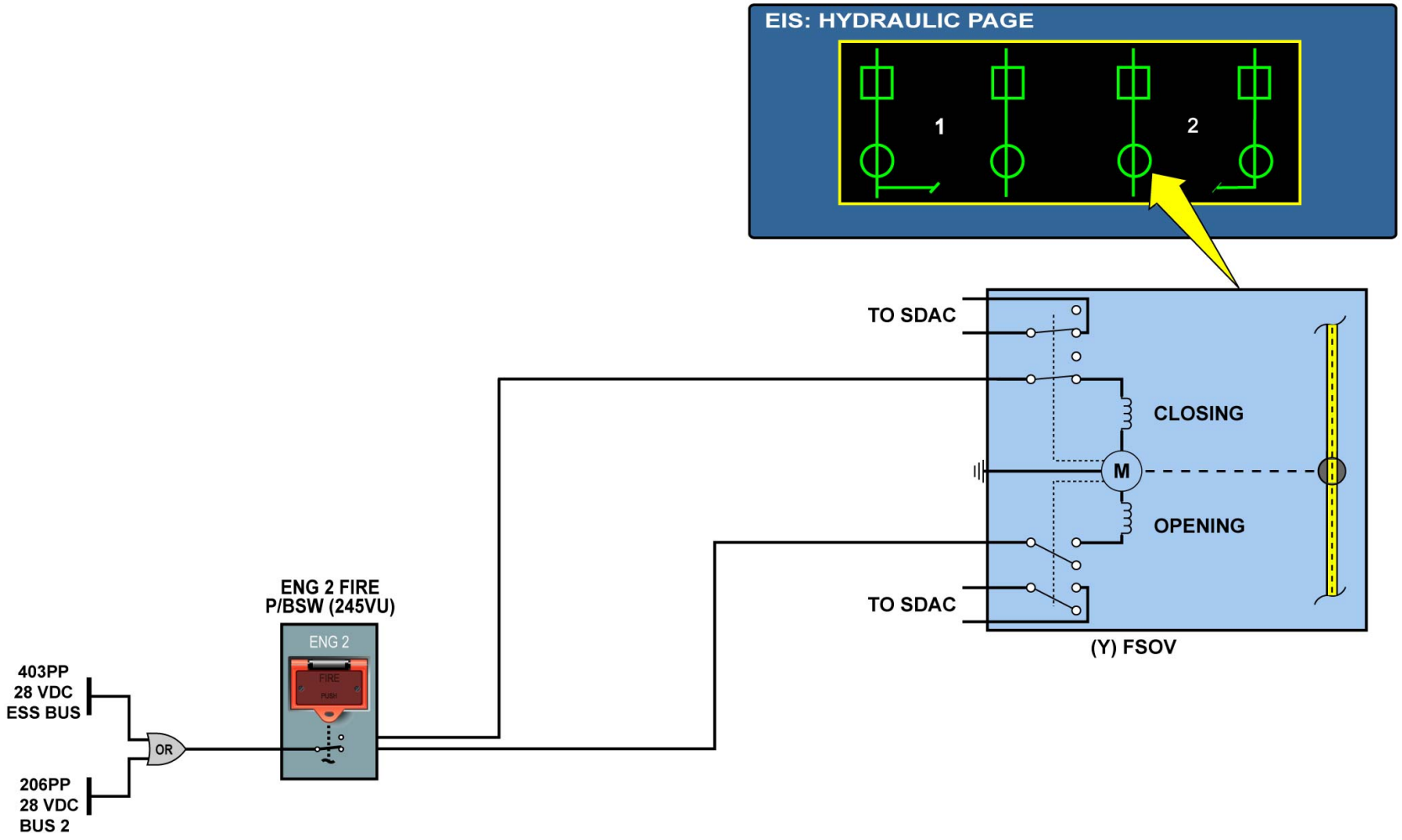
FSOV LOGIC



FSOV OPERATION

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YELLOW HYDRAULIC SYSTEM D/O (3)

EDP LOGIC OPERATION

As soon as engine 2 is running, the pump pressurizes the system to 3000 psi. A pressure switch monitors the output pressure. If the pressure drops below 1750 psi while the engine is running, the HSMU triggers the FAULT indication on the yellow HYD ENG 2 pump P/BSW. The pressure switch also sends a pump low pressure signal to the SDAC for the ECAM indication and related warnings activation. The FAULT indication is inhibited when there is no signal from the Engine Electronic Controller (EEC). When the yellow HYD ENG 2 pump P/BSW is released out, the depressurization solenoid valve of the related pump is energized and the pump no longer supplies fluid. In this case the related OFF legend comes on.

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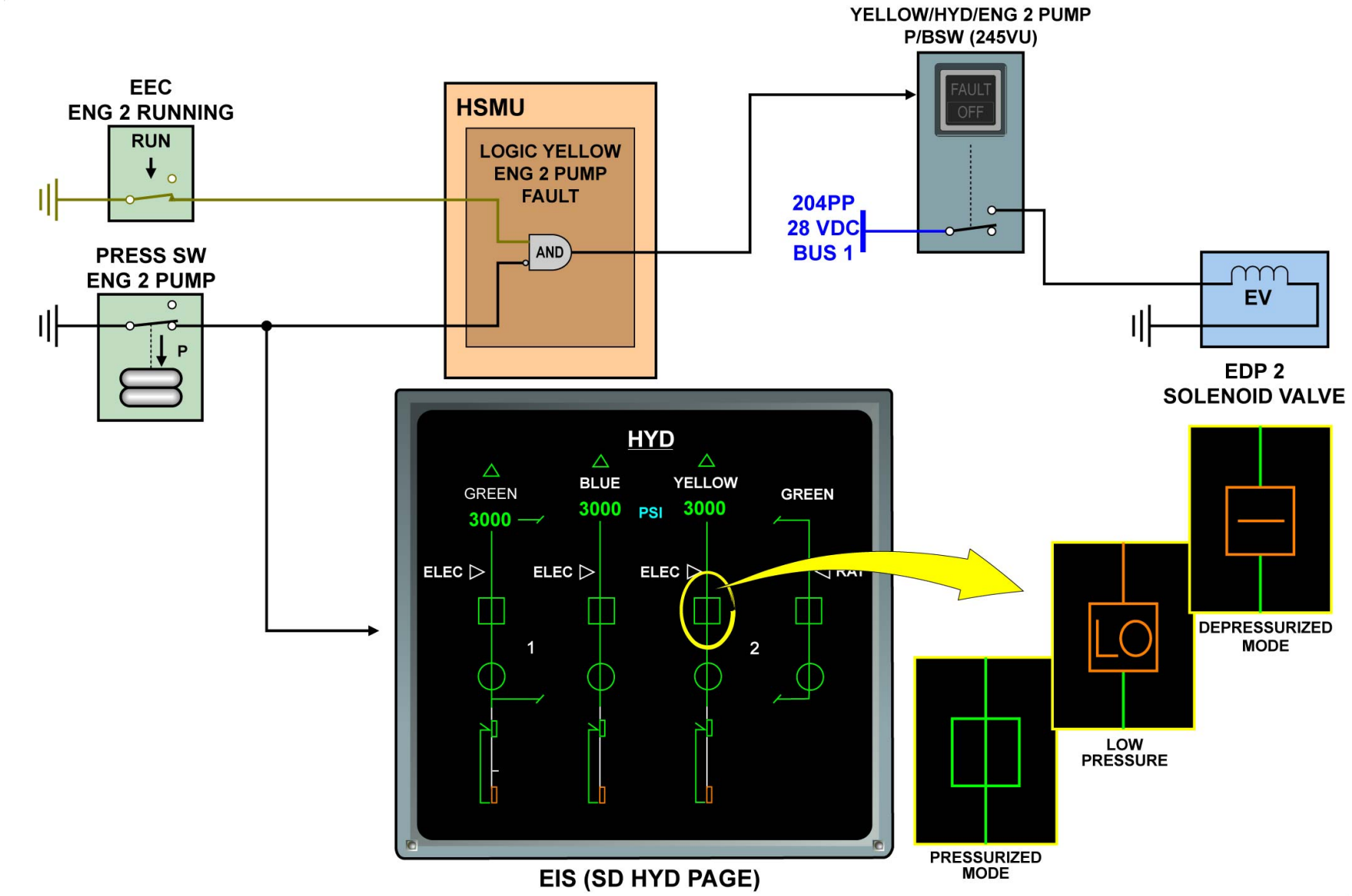

EDP LOGIC OPERATION

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YELLOW HYDRAULIC SYSTEM D/O (3)

ELEC PUMP AUTO START - CARGO DOOR OPS (MAINT BUS "ON")

GENERAL:
Manual control, low pressure monitoring, overheat monitoring and current unbalance monitoring of the yellow electric pump are not described in this topic due to similarity with the green and blue electric pumps. The topics describing these functions in detail for the green and blue electric pumps can be referred to for the yellow electric pump. Only the specific automatic control of the yellow electric pump is described below.
AUTOMATIC CONTROL:
The yellow electric pump can be controlled automatically by the HSMU. The control logics are as follows:
Flight logic:
Aircraft in flight (input from LGCIU) AND airspeed above 100 kts (input from ADIRU) AND engine 2 failed (HP compressor below 50% input from EIVMU) AND flap/slat lever not at zero AND green electrical pump not running automatically for landing gear retraction => yellow electric pump starts and keeps running until last engine shut down.
The purpose of this logic is to ensure that, with engine 2 failed (yellow hydraulic system not pressurized by the yellow EDP), the flap retraction does not last longer than in normal configuration with two engines running. Experiencing the aerodynamic drag of the flaps in-transit configuration during an abnormal long time would not be compatible with the loss of engine thrust.
Ground logic:
The yellow electric pump is controlled automatically by the HSMU during FWD and/or AFT cargo door operation in order to supply the cargo doors hydraulic actuators.
Automatic start of the yellow electric pump is controlled by the HSMU when a cargo door operation lever (FWD and/or AFT) is set to OPEN or CLOSE.
The pump is kept running by the HSMU for 10 seconds after the cargo door lever is released to the STOP position.
When the yellow electric pump is running automatically for cargo door operation, for safety reasons, the HSMU closes the yellow Leak Measurement Valve (LMV) to prevent movement of the related primary flight control surfaces and outputs a signal to the SFCC2 for inhibition of flap operation.
Note (for RR and PW engines only): During cargo doors operation, the engine 2 thrust reverser is the only yellow system device which is not inhibited automatically.
If the 4JJ P/BSW is in the normal pressed-in position, automatic control of the yellow electric pump for cargo door operation is possible whatever the aircraft electrical status, energized or not.
A/C NOT ENERGIZED:
If the aircraft is not energized (external power AVAIL in the cockpit but not switched ON), the automatic start logic of the yellow electric pump for cargo door operation is only available if the MAINT BUS is switched ON in the cabin (toggle switch on 5001VE panel). In this case the 28 VDC electric pump control loop is supplied from the 601PP SERV BUS.
When a cargo door operation lever is set to OPEN or CLOSE the Proximity Switch Control Unit (PSCU 5MJ, refer to ATA 52 presentation) energizes the CARGO DOOR RELAY; this relay closes; the HSMU gets a +28 VDC signal through the 8JJ PWR SPLY relay (de-energized open) and through the 4JJ P/BSW; by software logic, the HSMU closes the electrical pump control loop; the RCCB 3JJ2 is energized; it closes; the motor of the electric pump is supplied directly from the GPU; the electric pump runs.
The HSMU also illuminates the cyan ON legend on the 6JJ P/BSW.
When the cargo door operation lever is released to the STOP position, the CARGO DOOR RELAY is de-energized by the PSCU; the + 28VDC signal is no longer received by the HSMU but the electric pump control loop is kept closed (so the pump running) for 10 seconds. After this time delay the HSMU opens the control loop. The RCCB 3JJ2 is de-energized,

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it opens; the pump motor is no longer supplied from the GPU; it stops running.
The HSMU also extinguishes the cyan ON legend on the 6JJ P/BSW.

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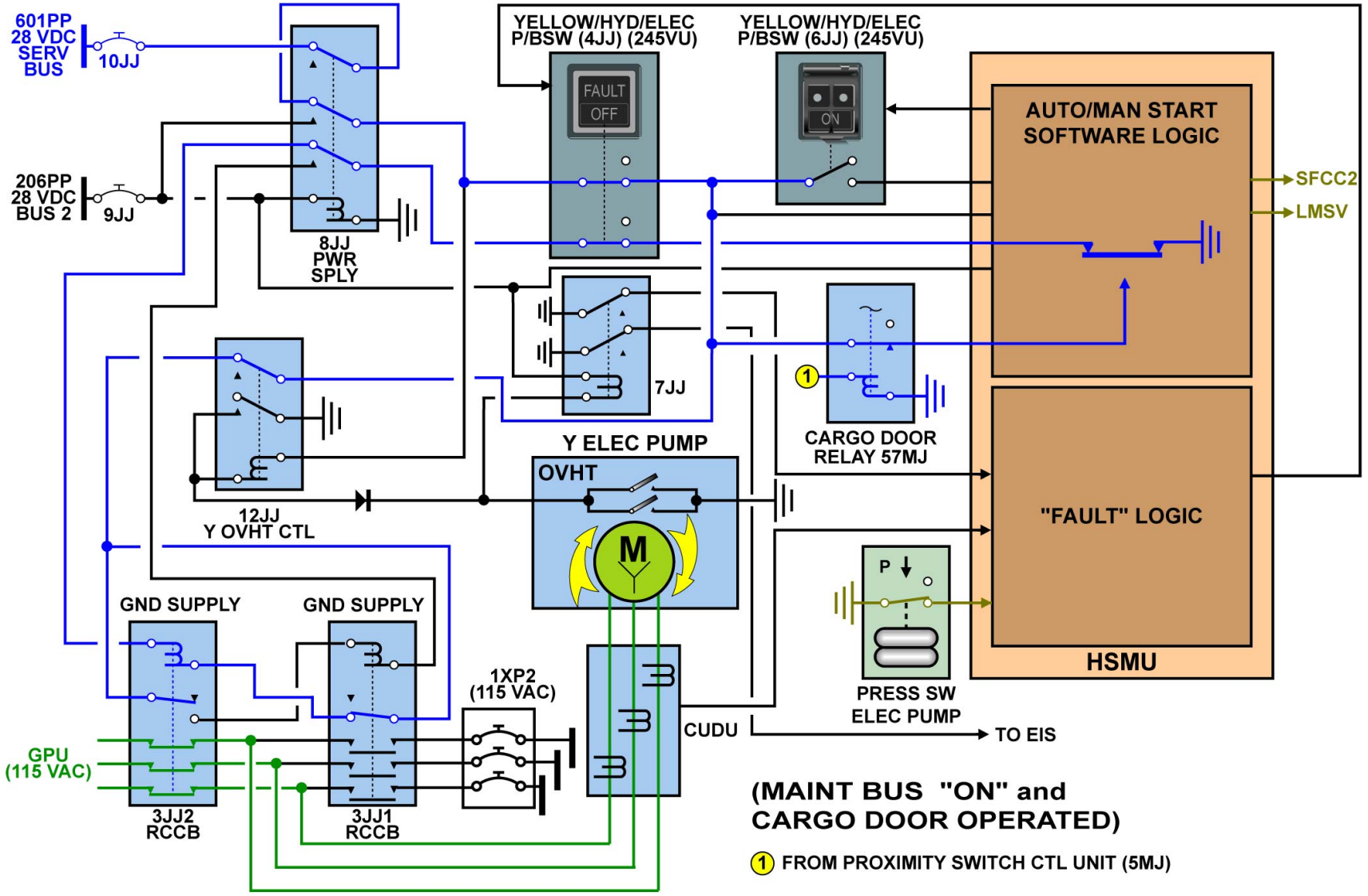

ELEC PUMP AUTO START - CARGO DOOR OPS (MAINT BUS "ON")

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YELLOW HYDRAULIC SYSTEM D/O (3)

ELEC PUMP AUTO START - CARGO DOOR OPS (EXT. POWER IN COCKPIT "ON")

A/C ENERGIZED:
When the aircraft is energized (external power ON in the cockpit), the 206PP 28VDC BUS energizes the PWR SPLY 8JJ relay, this relay is closed. In this case the yellow electric control loop is supplied from the 206PP BUS (whatever the position of the MAINT BUS toggle switch on the 5001VE).
When a cargo door operation lever is set to OPEN or CLOSE the Proximity Switch Control Unit (PSCU 5MJ, refer to ATA 52 presentation) energizes the CARGO DOOR RELAY; this relay closes; the HSMU gets a +28 VDC signal through the 8JJ PWR SPLY relay and through the 4JJ P/BSW; by software logic, the HSMU closes the electrical pump control loop; the RCCB 3JJ1 is energized; it closes; the motor of the electric pump is supplied from the 1XP2 bus; the electric pump runs.
The HSMU also illuminates the cyan ON legend on the 6JJ P/BSW.
When the cargo door operation lever is released to the STOP position, the CARGO DOOR RELAY is de-energized by the PSCU; the + 28VDC signal is no longer received by the HSMU but the electric pump control loop is kept closed (so the pump running) for 10 seconds. After this time delay the HSMU opens the control loop. The RCCB 3JJ1 is de-energized, it opens; the pump motor is no longer supplied from the 1XP2; it stops running.
The HSMU also extinguishes the cyan ON legend on the 6JJ P/BSW.

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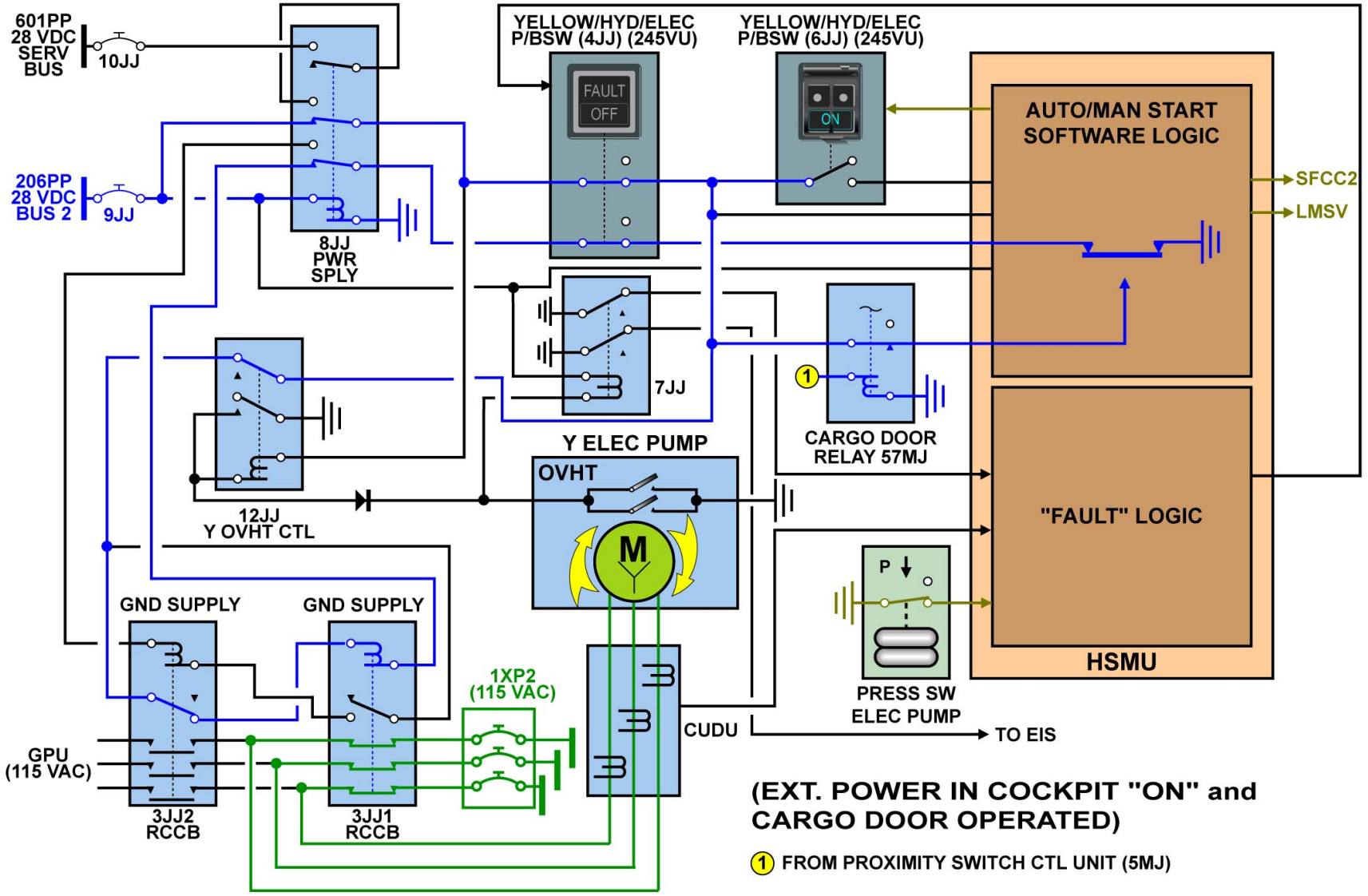

ELEC PUMP AUTO START - CARGO DOOR OPS (EXT. POWER IN COCKPIT "ON")

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YELLOW HYDRAULIC SYSTEM D/O (3)

CURRENT UNBALANCE DETECTOR UNITS (CUDU)

The CUDUs monitor the supply current of the electric pumps. They detect a current unbalance or the cut-off of one or two phases in the three phases power supply of the electric pumps. They send, to the HSMU, a signal to cut-off the power supply of the contactors related to the electric pumps when they detect an unbalance between the three phases. Switching off the power supply of the current unbalance detector units launches the reset.
A test pushbutton associated to an annunciator light comes on when the test has been done and the CUDU operates properly.

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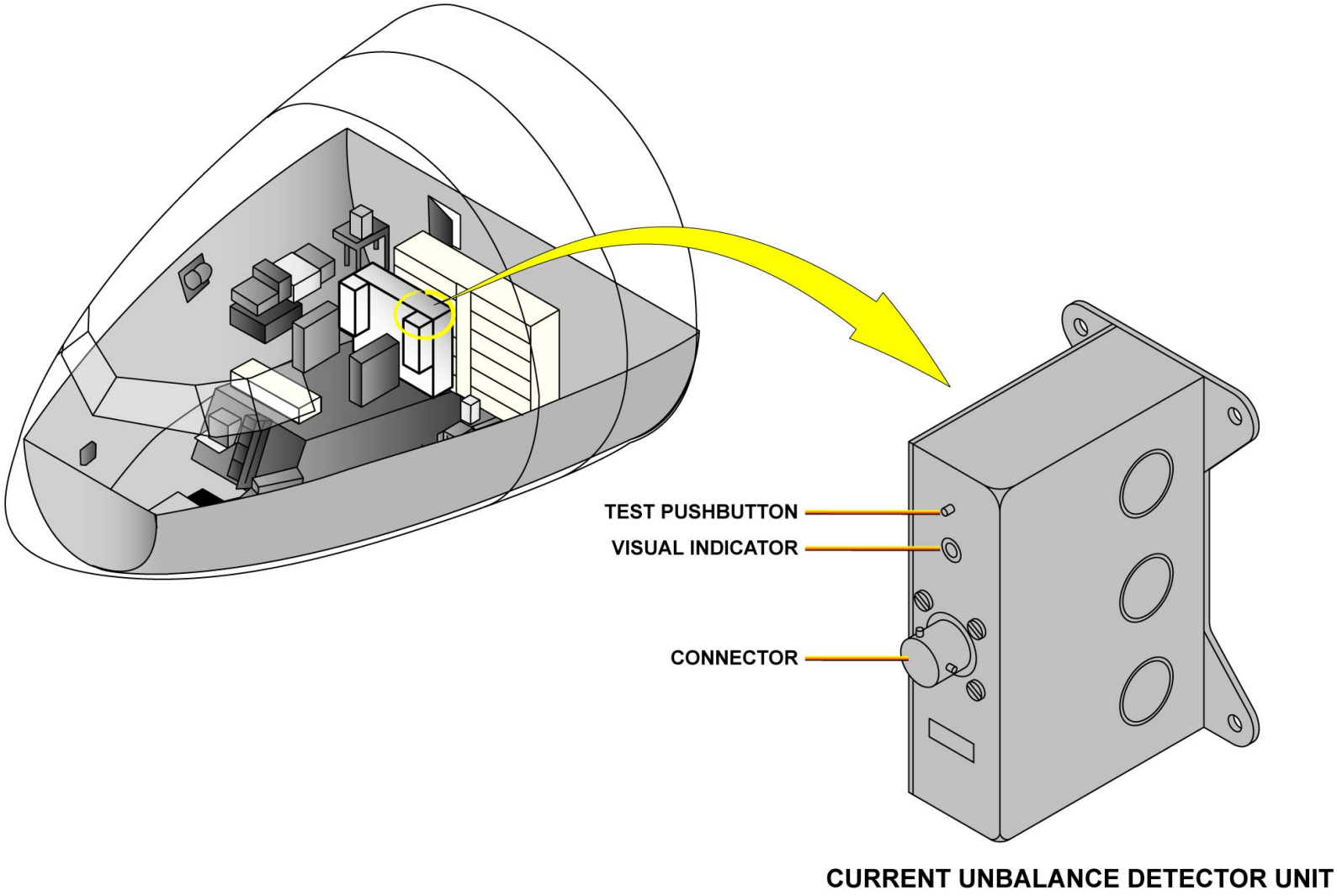

CURRENT UNBALANCE DETECTOR UNITS (CUDU)

YELLOW HYDRAULIC SYSTEM D/O (3)

DISTRIBUTION INDICATIONS

The pressure transducer sends an analog signal, which is used to monitor the hydraulic system pressure on the hydraulic ECAM page.
This same signal is also sent to the flight control system in order to give pressure indication. The leak measurement solenoid valve is normally de-energized open. The solenoid valve is energized closed when the Yellow LEAK MEASUREMENT VALVE P/BSW located on the maintenance panel is pressed in. This makes the flight controls hydraulically isolated. The valve closure is inhibited in flight above 100 Kts, using information from Air Data/Inertial Reference Units (ADIRUs) 1 & 3 and Landing Gear Control and Interface Units (LGCIUs).
The pressure switch sends a discrete signal if the pressure is less than 1450 psi. This signal is used for ECAM indication on the hydraulic page and for warning messages. This signal is also used by the flight control system. A second pressure switch is only allocated to give pressure information to the flight control system. The ground service manifold is used during the ground leak test, to selectively let the hydraulic supply to the flight controls when the leak measurement valve is closed.

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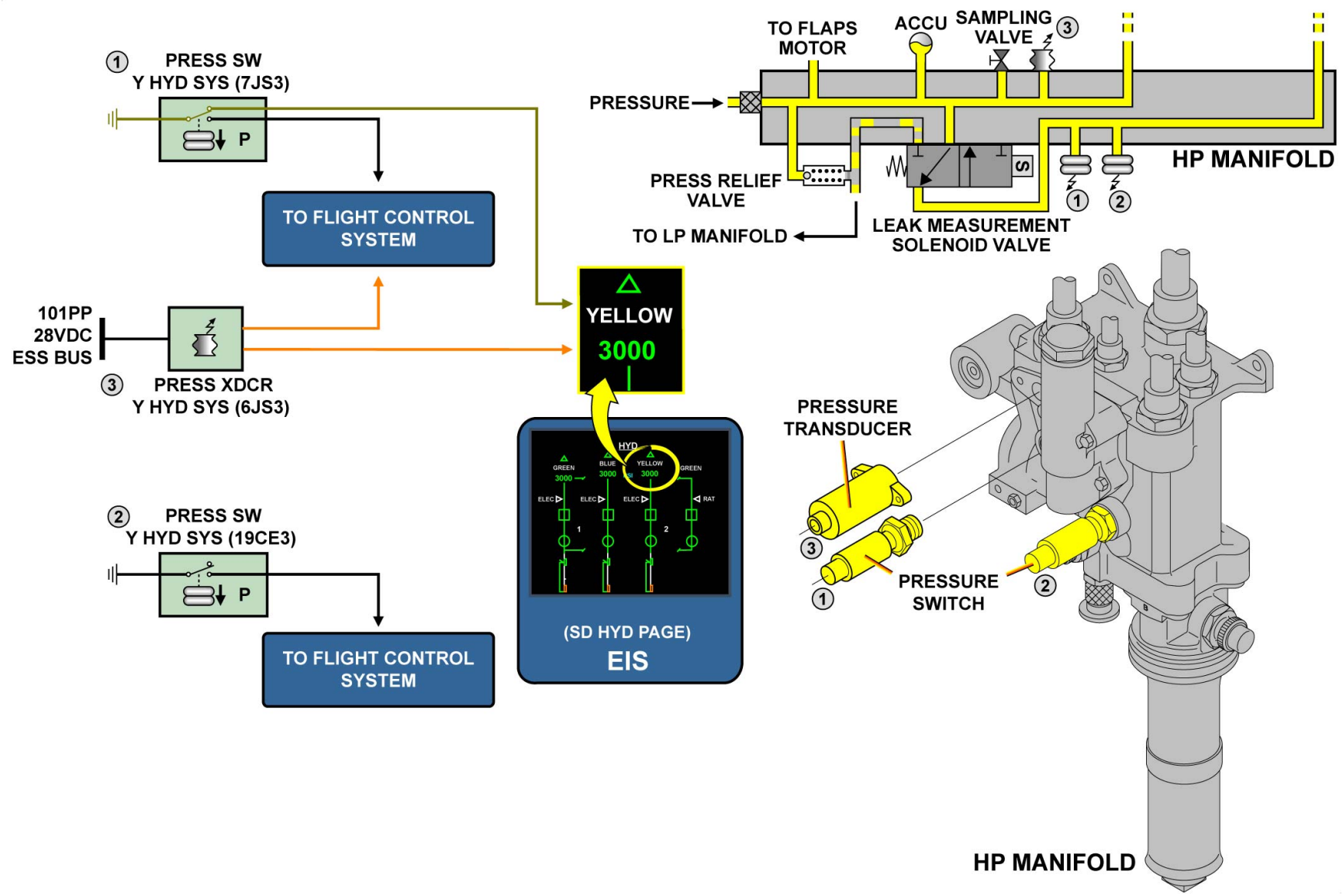

DISTRIBUTION INDICATIONS

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SEAL DRAIN D/O (3)

GENERAL

In order to have the hydraulic compartment as clean as possible this system collects the hydraulic fluid leakage in transparent tanks. The system is designed so that fluid drains into the recovery tanks under the influence of gravity. If a tank is full, an overflow-pipe drains the excessive fluid into the MLG bay.

SYSTEM DIVISION

The seal drain system drains the leaks of the following equipment into three recovery tanks:
- hydraulic motors of flaps and slats,
- reservoirs,
- emergency electrical generator,
- electrical motor pumps.

Tank 1 in the yellow hydraulic compartment drains:
- the yellow system reservoir via the air-relief valve,
- the blue system reservoir via the air-relief valve,
- the slats Power Control Unit (PCU),
- the yellow electric pump.

Tank 2 in the green hydraulic compartment drains:
- the green system reservoir via the air-relief valve,
- the Constant Speed Motor/Generator (CSM/G),
- the flaps PCU,
- the green electric pump.

Tank 3 in the blue hydraulic compartment drains the blue electric pump.

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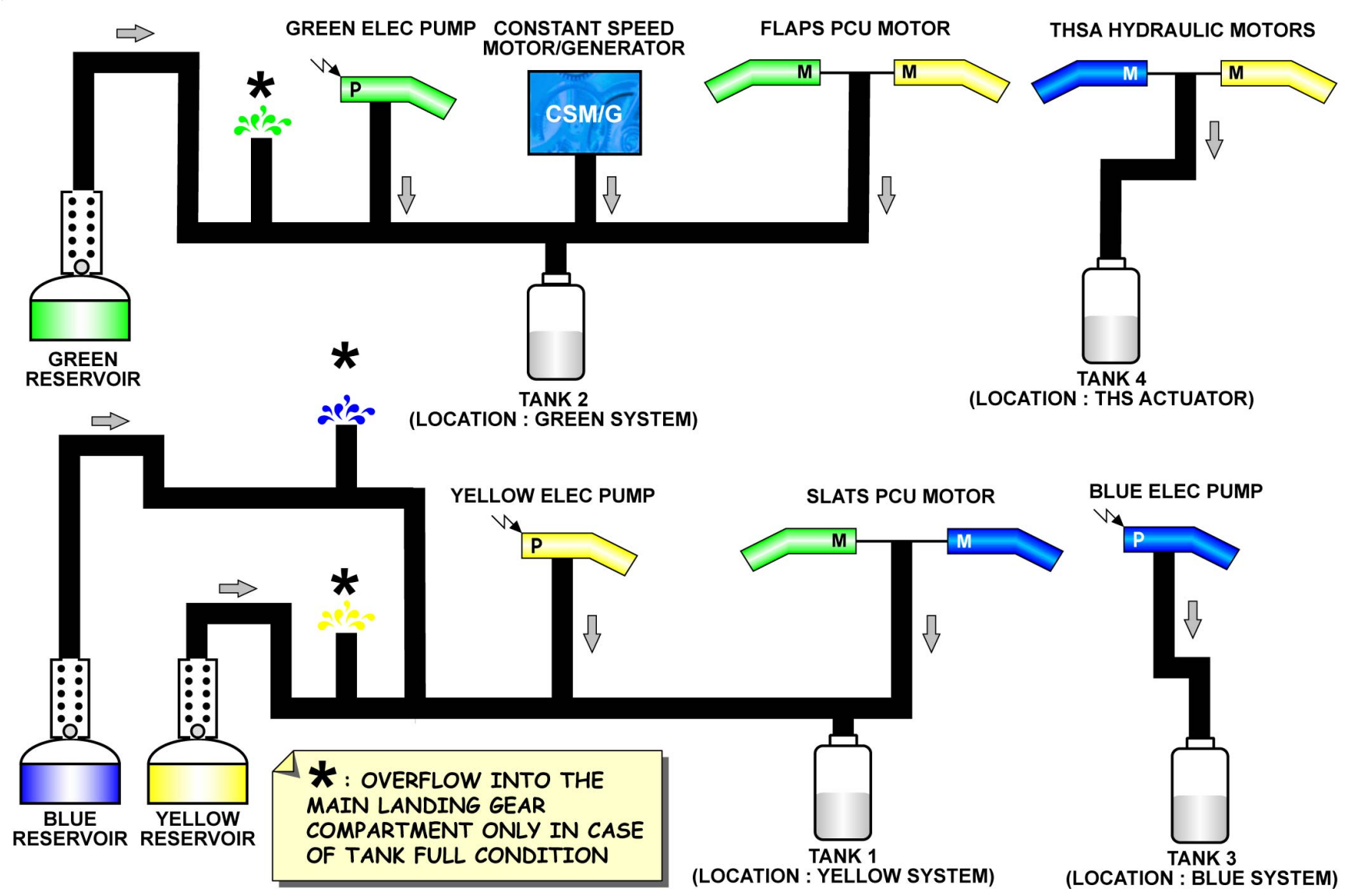

GENERAL & SYSTEM DIVISION

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SEAL DRAIN D/O (3)

RECOVERY TANKS

The three recovery tanks are made of plastic. They are attached to the structure with quick-release clamps to make them easier to empty. It is necessary to remove the hydraulic fluid at regular intervals.

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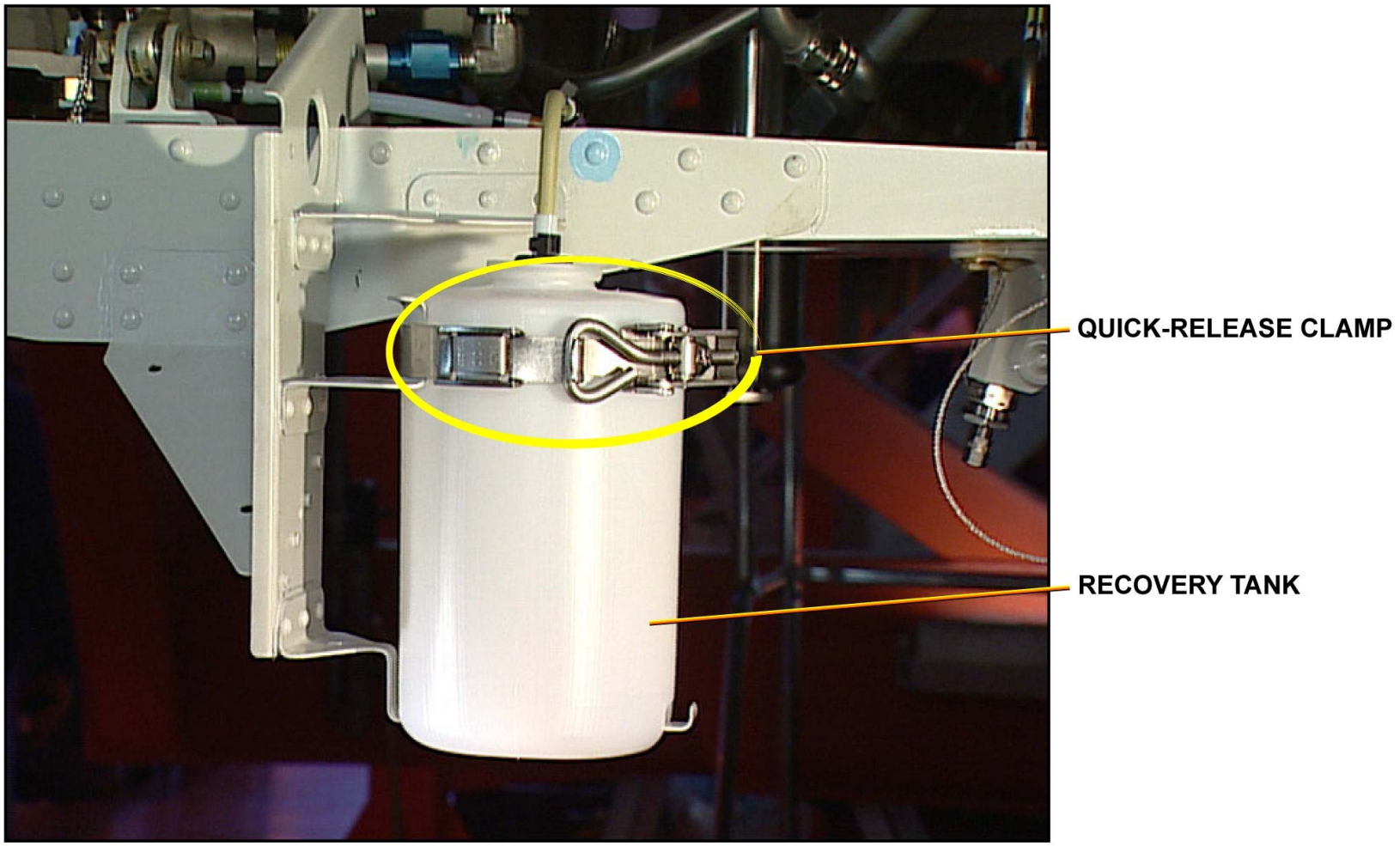

RECOVERY TANKS

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LEAK TEST D/O (3)

GENERAL

The purpose of the internal leak test is to make sure that the internal leakage of a system is within certain limits define in AMM. As the internal leak system is the same for the three hydraulic circuits, and as the three systems have the same internal leak test, this presentation is based on the green system.
A portable Ground Service Equipment (GSE) taking advantage of the Ultra-Sonic Flow Measurement (USF) technology does the flow measurement. The USF allows local fluid displacement measurement through individual pipes and is a pure GSE, which is not installed permanently on the A/C.
The measurement of the internal leakage is performed with the hydraulic systems pressurized by the electrical pumps.
Using USF technology compared to GSM installed on aircraft offers several advantages like:
- Increasing of system reliability,
- Reduction of the maintenance costs,
- Save time during scheduled internal leakage check,
- Save weight on A/C,
- Quick troubleshooting,
- Less spare-parts in storage,
- USF can be used for the complete fleet.

On each system, the internal leak test system comprises:
- a solenoid valve installed on the High Pressure (HP) manifold,
- a hydraulic (HYD)/leak measurement valves P/BSW.

SAFETY PRECAUTIONS

Obey these safety precautions:

WARNING: MAKE SURE THAT THE SAFETY DEVICES AND THE WARNING NOTICES ARE IN POSITION BEFORE YOU START A TASK ON OR NEAR:
-THE FLIGHT CONTROLS,
-THE FLIGHT CONTROL SURFACES,
-THE L/G AND THE RELATED DOORS,
-COMPONENTS THAT MOVE.
MOVEMENT OF COMPONENTS CAN KILL OR INJURE PERSONS.
MAKE SURE THAT THE GROUND SAFETY-LOCKS ARE CORRECTLY INSTALLED ON THE L/G.
THIS PREVENTS UNWANTED MOVEMENT OF THE L/G.

CAUTION: Do not operate the flaps and slats when one or more leak measurement valve P/BSW is in the released position ("OFF" legend on).
Operation of the flaps and slats in this configuration can cause jamming of the mechanical transmission.

Make sure that the primary (PRIM) and secondary (SEC) P/BSW are pushed in (the OFF and FAULT legends are off). Make sure that the flap and slat control lever is in the 0 degree position. Keep all the control surfaces in the 0 degree position during the measurement of the internal leakage. Even if the hydraulic users are at neutral, there is a permanent flow. If this flow is too high, the corresponding system operation will be affected. The internal leakage check has to be done with the hydraulic fluid at its usual operation temperature.

LEAK MEASUREMENT SOLENOID VALVE

The leak measurement solenoid valves are used to isolate the hydraulic supply of the primary flight controls.
These valves are only used on ground.

NOTE: For safety reason, the leak measurement solenoid supplies, of all systems are inhibited above 100 Kts.

Selecting the leak measurement solenoid valve P/BSW isolates the hydraulic system of the flight controls. The leak measurement solenoid valve control panel is located on the HYD maintenance overhead panel.
When one leak measurement P/B SW is released on ground the related:
- System leak measurement valve closes.
- Leak measurement P/B SW ON light comes on.

NOTE: On ground, the yellow leak measurement valve is automatically closed during cargo doors operation.

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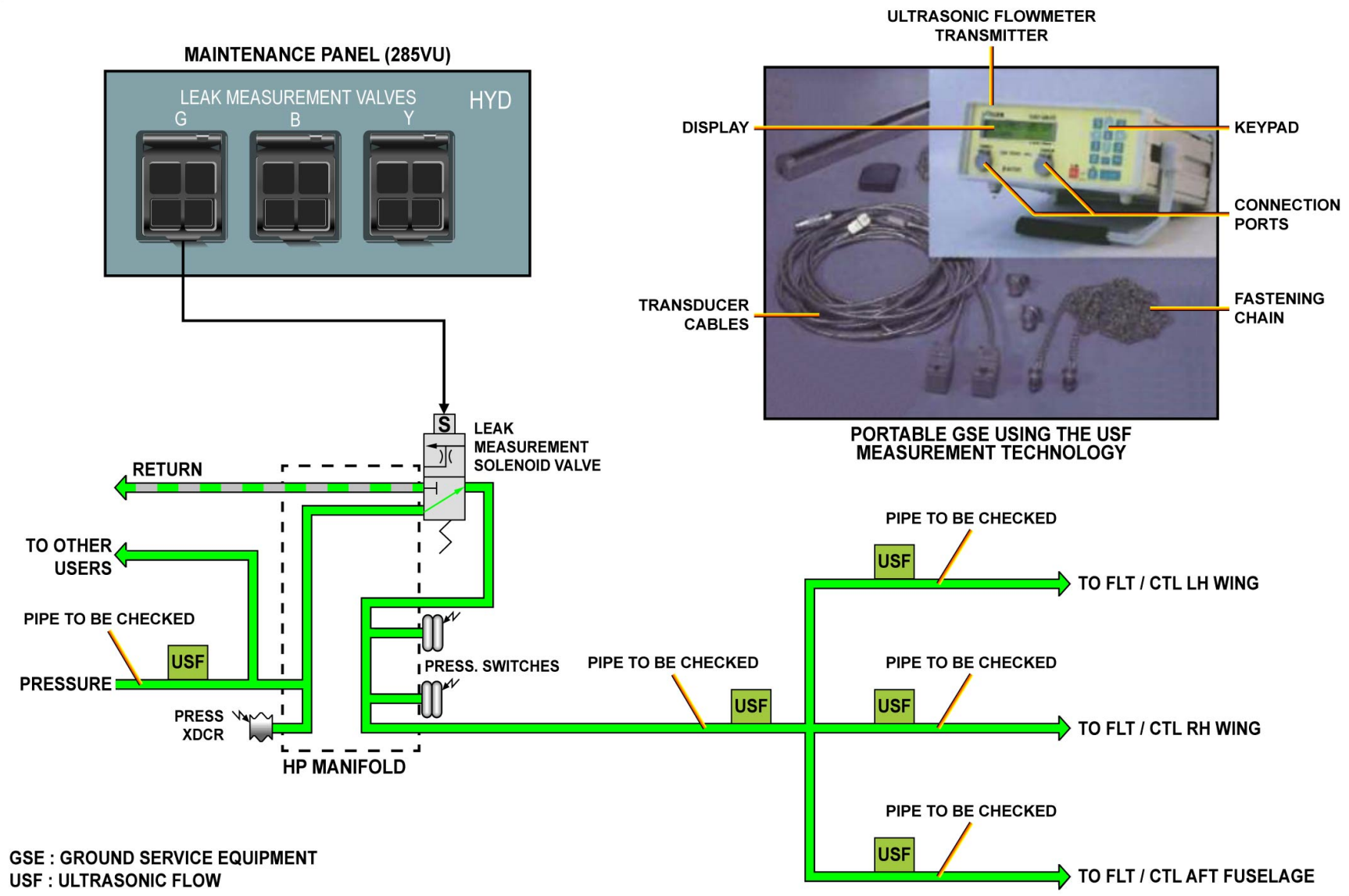

GENERAL & LEAK MEASUREMENT SOLENOID VALVE

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LEAK TEST D/O (3)

MEASUREMENT OF THE INTERNAL LEAKAGE METHOD

An ultrasonic flow measurement measures the leak rate in hydraulic systems according to the ultrasonic transit time difference principle. The measurement is non invasive, absolutely no intrusion in the pipe system is needed.
Ultrasonic signals are sent by the transducer into the pipe, reflected on the inner pipe wall of the opposite side and come back to the transducer. These signals are emitted alternatively in the direction flow and against it.
The transit time difference t is measured and allows the determination of the average flow velocity on the propagation path of the ultrasonic signals. A profile correction is then performed to obtain the average flow velocity on the cross-section of the pipe, which is proportional to the volume flow rate.
The USM transducer has to be installed on predefined measurement points designated with specific tapes on the dedicated tubes.

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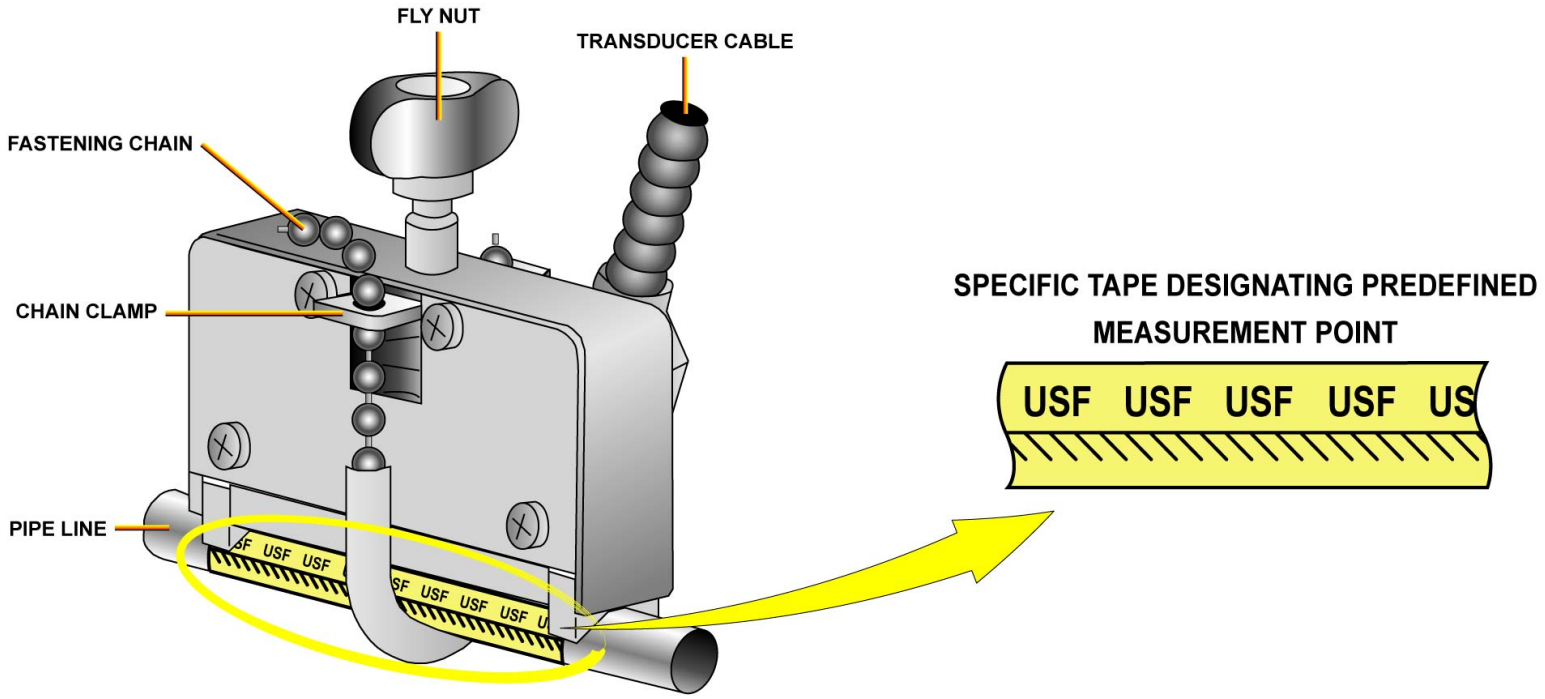

MEASUREMENT OF THE INTERNAL LEAKAGE METHOD

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LEAK TEST D/O (3)

PREDEFINED MEASUREMENT POINTS

The USF sensor head shall be attached in-between. These predefined measurement points are necessary to ensure data acquisition quality and accuracy.

NOTE: Note: The accuracy can vary up to 20% if an arbitrary measurement point is chosen.

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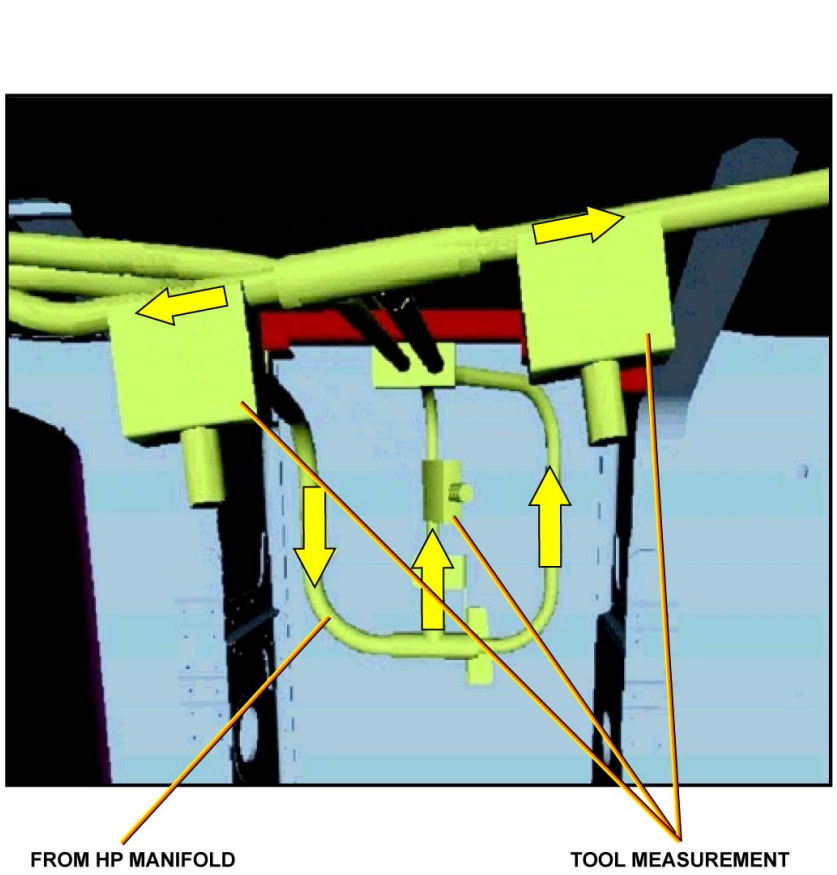
A330/A340 GREEN HYDRAULIC SYSTEM SHOWN FOR EXAMPLE



PREDEFINED MEASUREMENT POINTS

LEAK TEST D/O (3)

OPERATIONAL MODES

The USF has two operational modes. It can be used as a troubleshooting tool or as an internal leakage measurement tool.
For these 2 modes, the diagram describes the different steps that have to be followed to perform the measurement.

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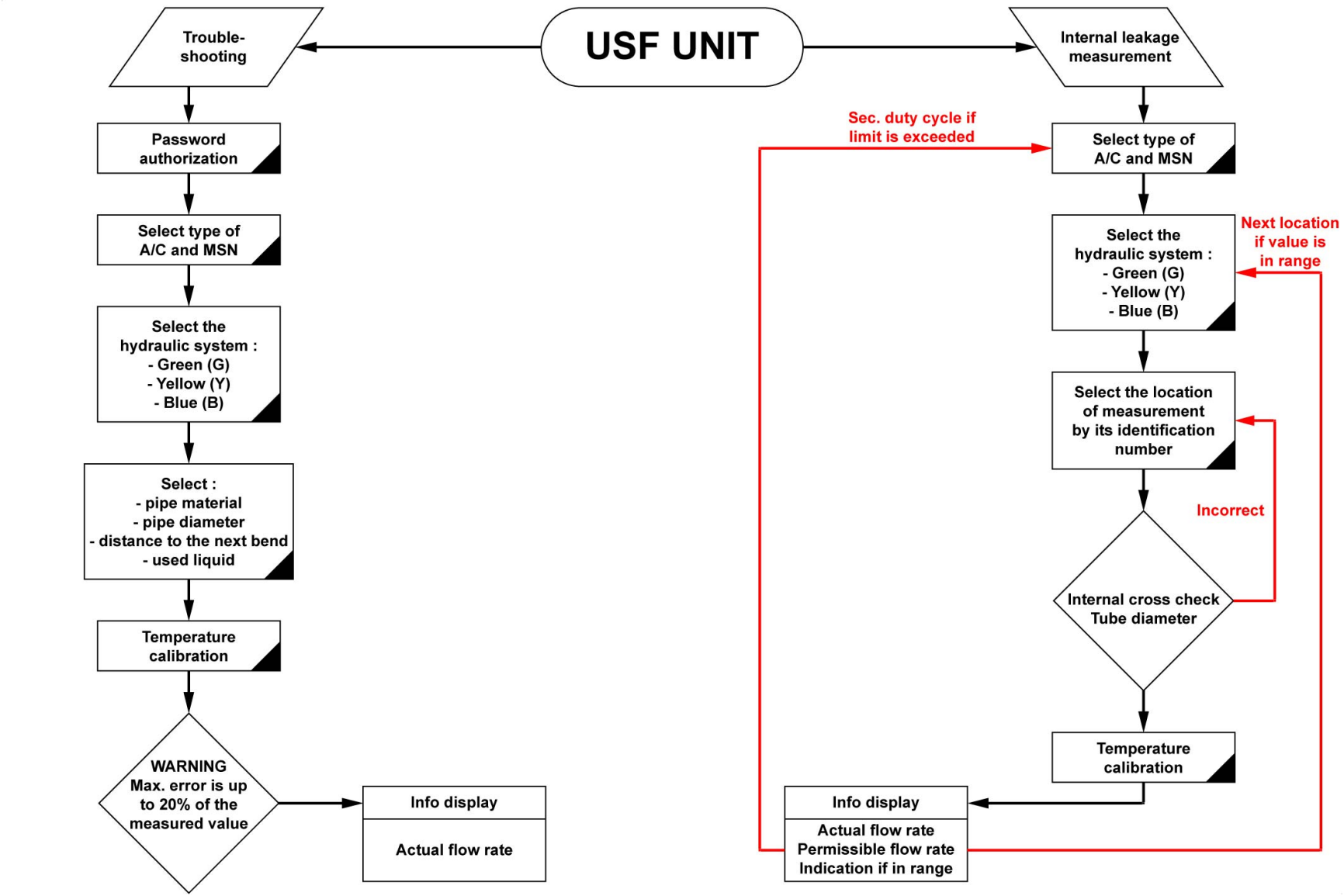
USF UNIT
Trouble-shooting
Password authorization
Select type of A/C and MSN
Select the hydraulic system : - Green (G) - Yellow (Y) - Blue (B)
Select : - pipe material - pipe diameter - distance to the next bend - used liquid
Temperature calibration
WARNING Max. error is up to 20% of the measured value
Info display
Actual flow rate
Internal leakage measurement
Sec. duty cycle if limit is exceeded
Select type of A/C and MSN
Next location if value is in range
Select the hydraulic system : - Green (G) - Yellow (Y) - Blue (B)
Select the location of measurement by its identification number
Incorrect
Internal cross check Tube diameter
Temperature calibration
Info display
Actual flow rate
Permissible flow rate
Indication if in range

OPERATIONAL MODES

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LEAK TEST D/O (3)

FULL SYSTEM CHECK

To make a full system check, it is necessary to pressurize the green system from the green system electrical pump, making sure that the green leak measurement valve P/BSW is pushed in (the "OFF" legend is off).
The USF transducer used to measure the flow should be installed upstream of the HP manifold.
Monitor the flow displayed on the USF transmitter and make sure that it is within limits given per AMM.
If the internal leakage is too high, do the check of sections of the system to isolate the faulty section.

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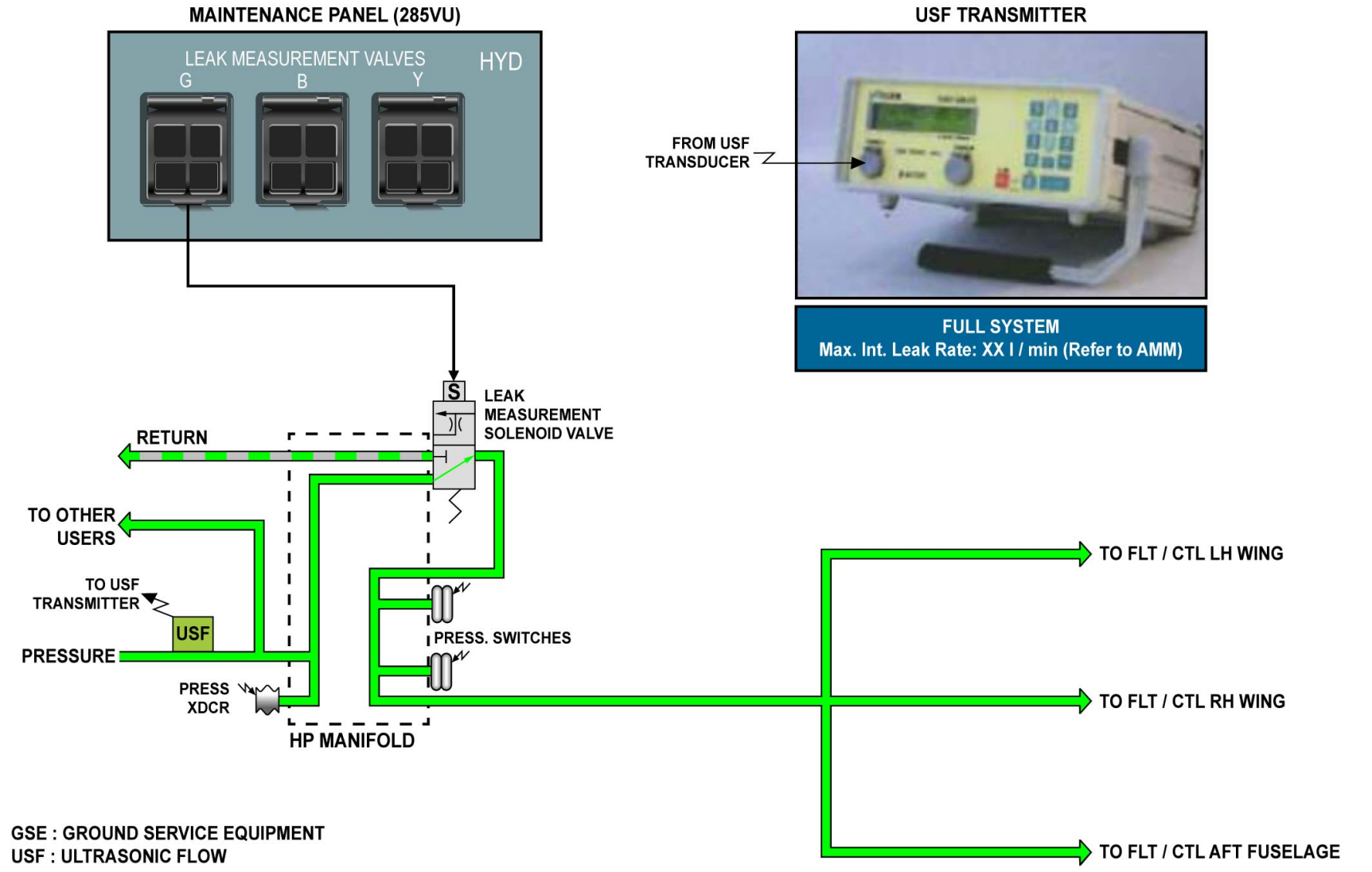

FULL SYSTEM CHECK

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LEAK TEST D/O (3)

FULL SYSTEM WITHOUT PRIMARY FLT / CTL CHECK

To isolate the faulty section/component, it is necessary to pressurize the green system from the Green Electrical Pump.
To test for leaks, it is necessary to isolate the primary flight controls by releasing the Green leak measurement valves P/BSW (the "OFF legend is on).
The PRIM flight controls are now depressurized.
Monitor the flow, send to the full system without Flight controls, displayed on the ground USF transmitter and make sure that it is within limits given per AMM.
If the internal leakage is too high, do the check of sections of the system to determine the cause.
According to the 2 first steps (full system and full system without primary flight controls) it is possible to identify if internal leak is either due to primary flight control or other user components.

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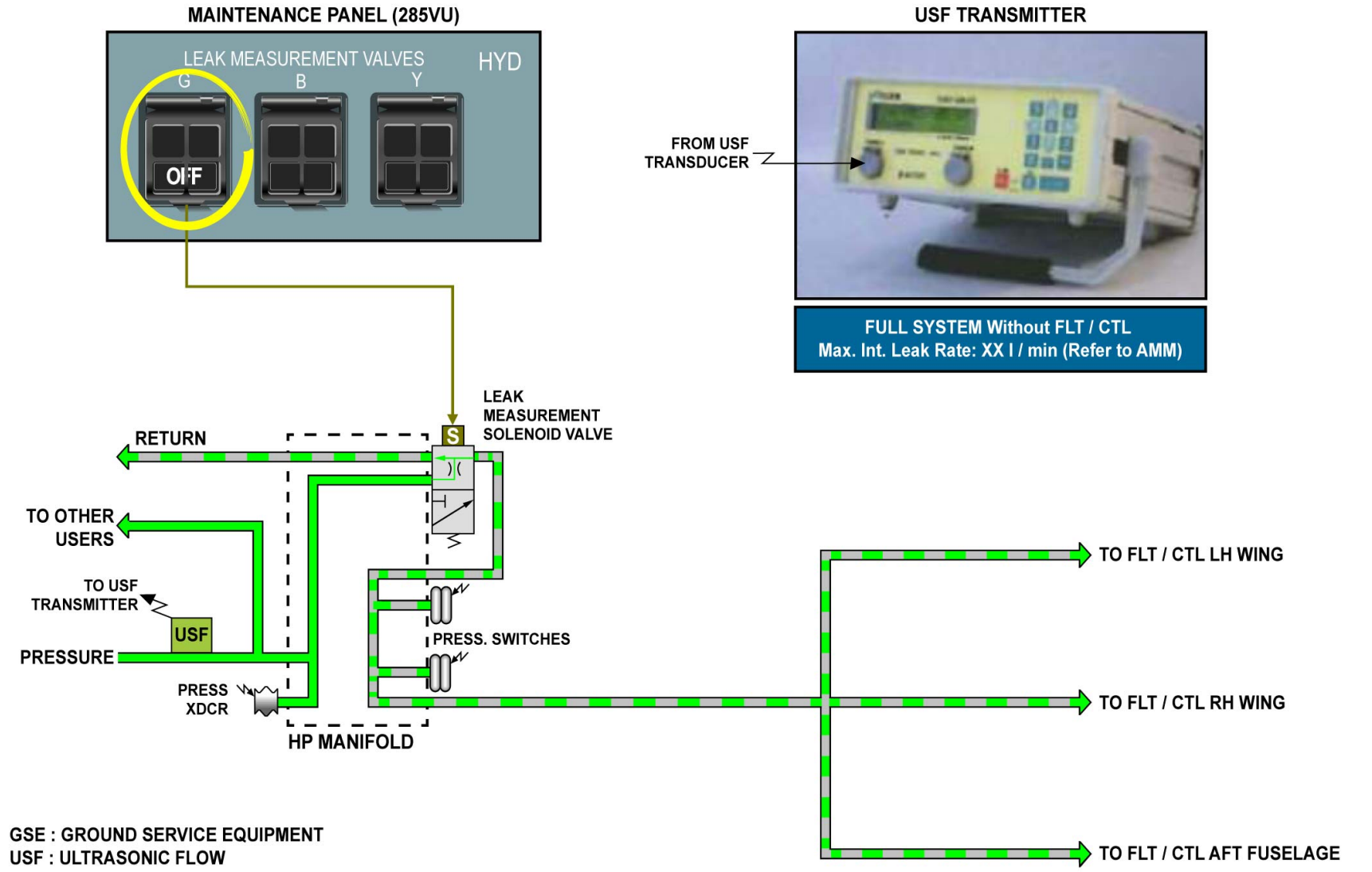

FULL SYSTEM WITHOUT PRIMARY FLT / CTL CHECK

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LEAK TEST D/O (3)

COMPONENTS CHECK

If the leak cause is the primary flight control, monitor each flight control section, one by one, by placing the UCF transducer on the dedicated pipes. If the internal leakage of the one section is too high, each component of this section will be checked one by one to isolate the faulty one(s).
To make a primary flight control section (RH wing, LH wing or AFT fuselage) check, it is necessary to make sure that the green leak measurement valve P/BSW is pushed in (the "OFF" legend is off).
For information, all components have a normal internal leak that heat component and avoid as result icing of it.
Nevertheless, high internal leak rate increases significantly component temperature. An excessive component body temperature, in conjunction with a whistling noise is an indication of a possible faulty component.

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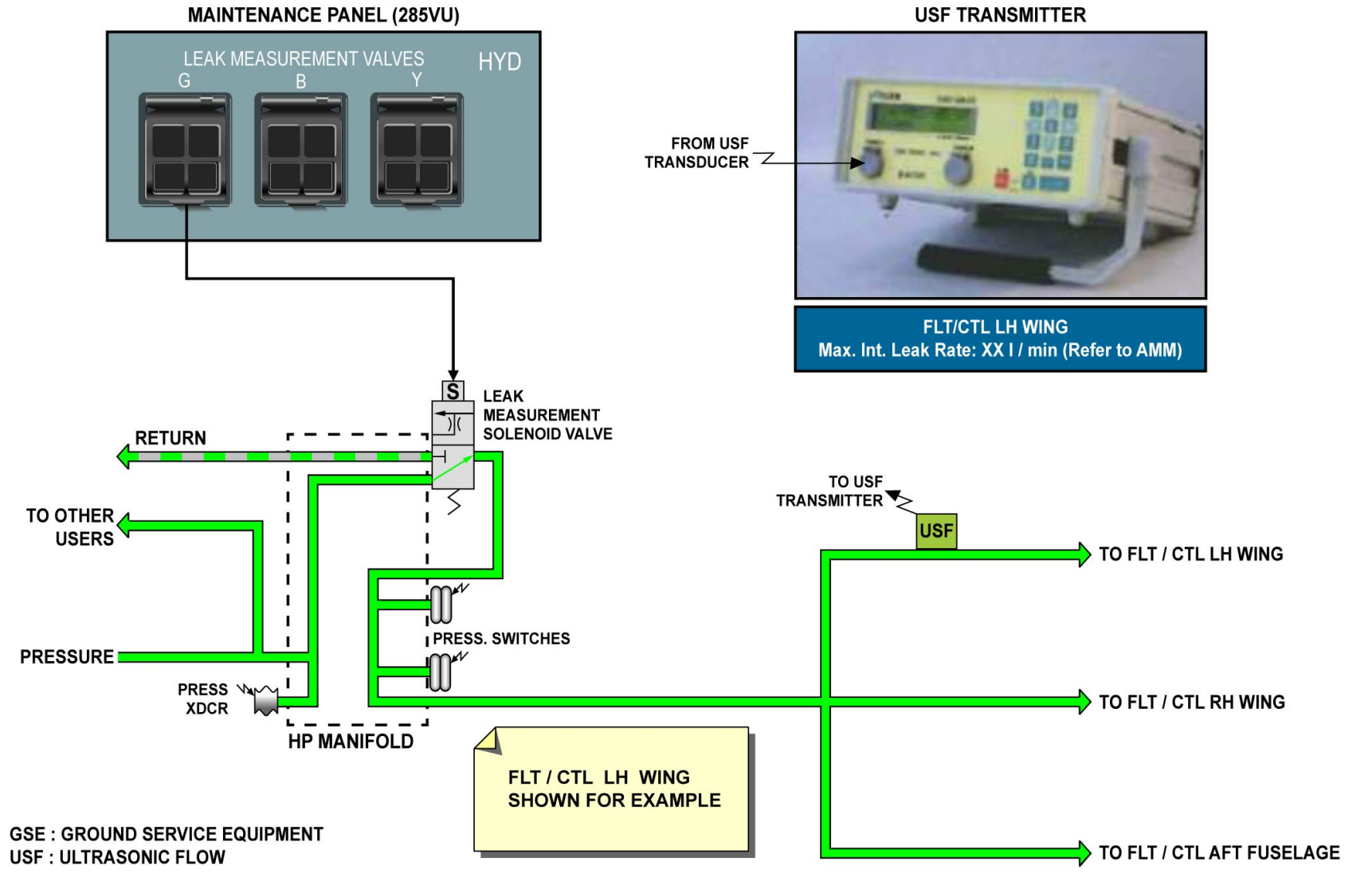

COMPONENTS CHECK

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RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

INTRODUCTION

Servicing and checking the condition of the Ram Air Turbine (RAT) manual deployment system is done in three stages. These are:
- operational test of the RAT manual extension/retraction,
- operational test of the RAT manual deployment: inspection and test with Aircraft Condition Monitoring System (ACMS),
- oil replenishment of the RAT.

WARNING: WHEN WORKING WITH HYDRAULIC COMPONENTS AND/OR FLUIDS, IT IS IMPORTANT TO FOLLOW THE PROPER SAFETY PRACTICES, ESPECIALLY BY PREVENTING CONTACT WITH SKIN OR EYES, AND ALSO AVOIDING SYSTEMS CONTAMINATION. WHEN PREPARING OPERATION AND TEST ON HYDRAULIC SYSTEMS, IT IS IMPORTANT TO MAKE SURE THE FLIGHT CONTROLS AND L/G AREAS ARE CLEAR, WITH SUITABLE SAFETY BARRIERS AND NOTICES IN PLACE.

When working near the location of the RAT, it is necessary to prevent inadvertent extension by installing the RAT safety pin. It must be removed before aircraft dispatch.

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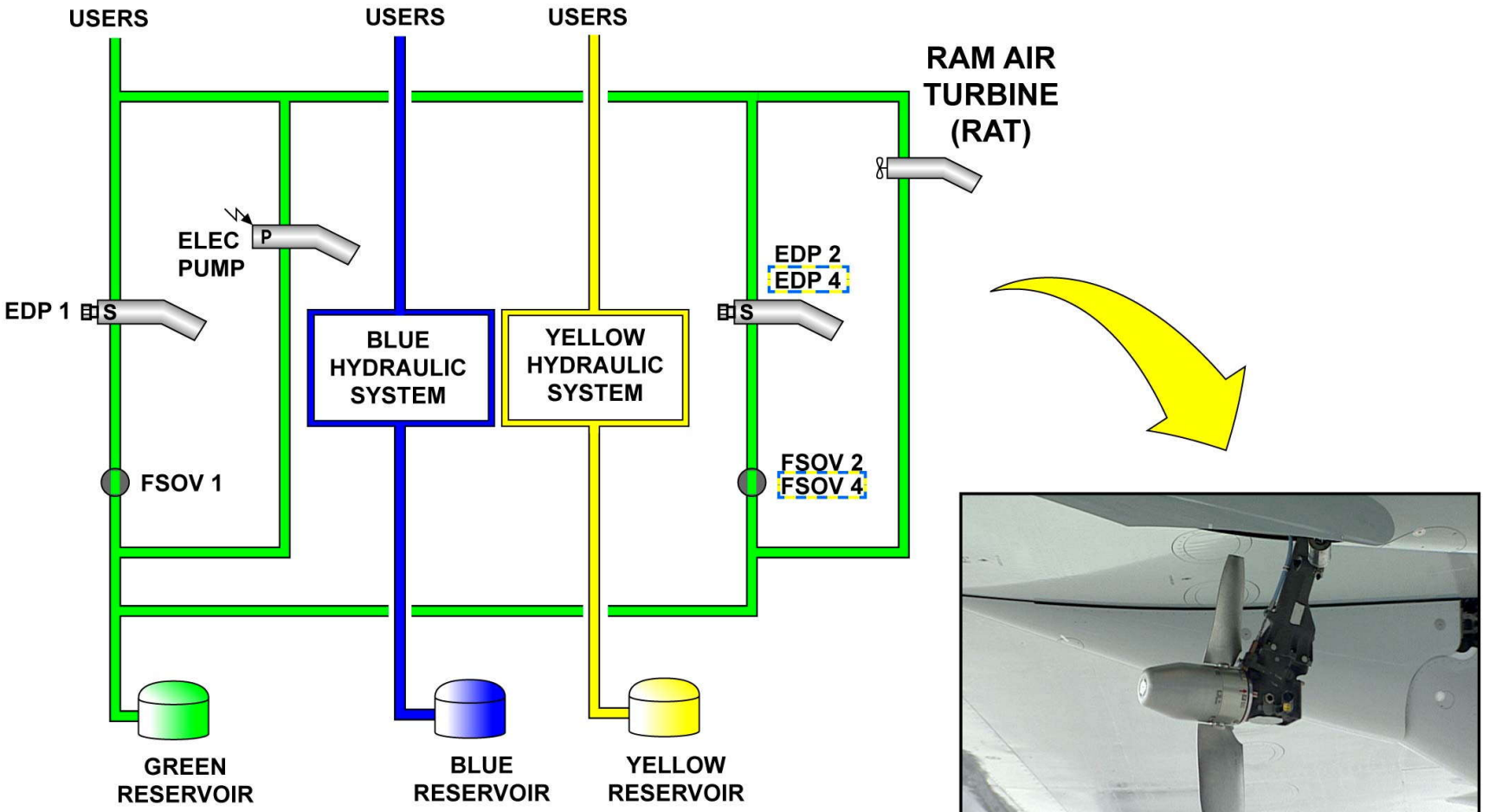


FOR A340-300

EDP : ENGINE DRIVEN PUMP
FSOV : FIRE SHUT OFF VALVE

INTRODUCTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION

The following tests check the condition of the RAT manual actuation system and of the RAT itself.

Operational Test of the RAT Manual Extension/Retraction

...
Job set-up
...

Make sure that the Green hydraulic system is depressurized.

...
Procedure
...

RAT extension

RAT inspection

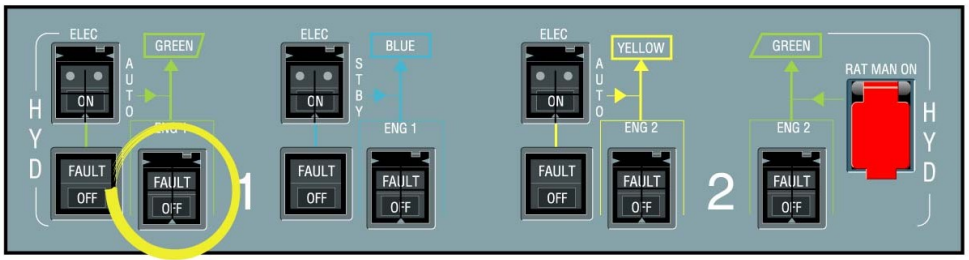
RAT retraction

Stowed RAT inspection

...
Close-up
...

RAT STOW PANEL

A330 HYDRAULIC PAGE (245VU)



RAT EXTENDED

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION (continued)

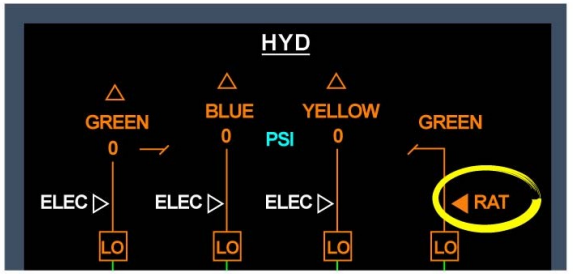
RAT EXTENSION

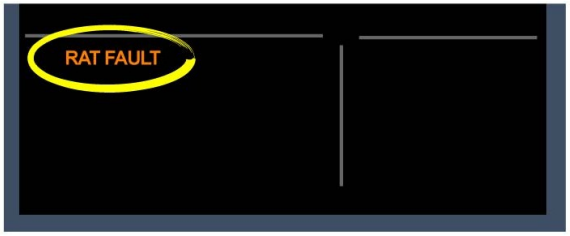
Install the safety pin and make sure that the green hydraulic system is depressurized. Push the RAT warming flow indicator from "out" to "in" position and remove the safety pin.
At the HYD panel, push the RAT MAN ON pushbutton, but not longer than 1 minute.
Check on the ECAM that the RAT triangle indication changes from white to amber and that the EWD RAT FAULT warning comes on.
The actual RAT extension must be observed.
On the RAT stow panel, switch the power ON and do the lamp test.

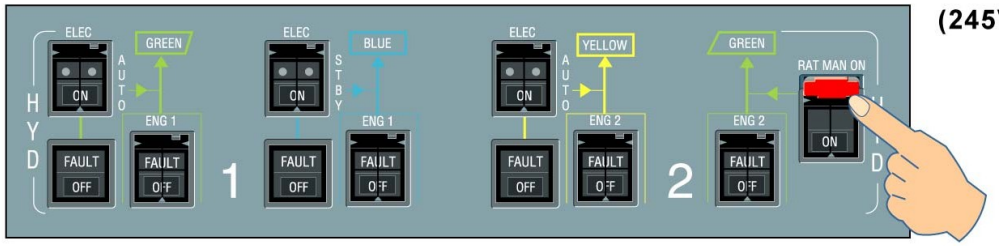
G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...
✓ **Job set-up**
...
✓ **Make sure that the Green hydraulic system is depressurized.**
...
Procedure
...
RAT extension
...
On the HYD panel 245VU: open the guard and push the RAT MAN ON pushbutton switch to ON.
...
On the RAT stow panel:
...
RAT inspection
RAT retraction
Stowed RAT inspection
...
Close-up
...







(245VU)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT EXTENSION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

RAT extension

...

On the HYD panel 245VU: open the guard and push the RAT MAN ON pushbutton switch to ON.

...

On the RAT stow panel:

...

RAT inspection

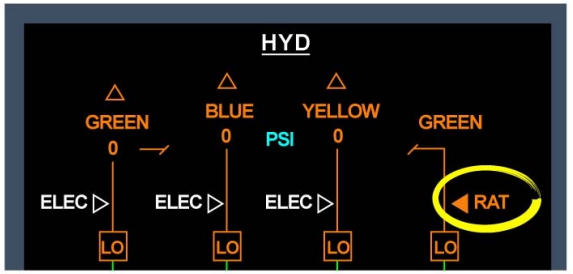
RAT retraction

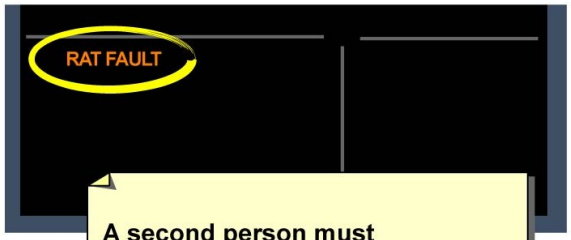
Stowed RAT inspection

...

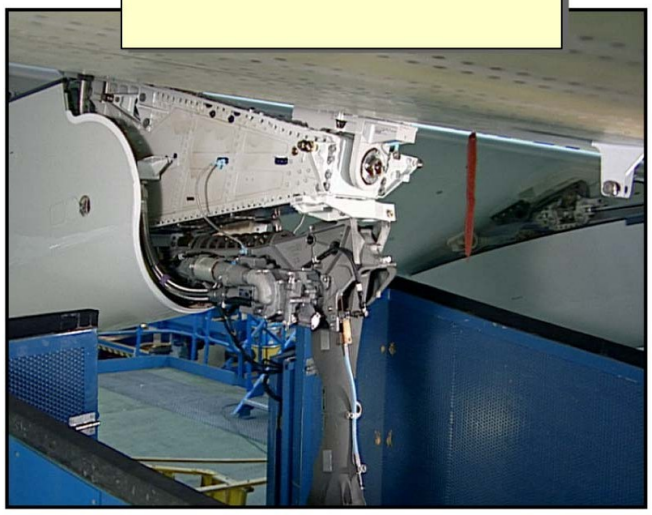
Close-up

...





A second person must examine the extension of the RAT



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT EXTENSION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

RAT extension

...

✓ On the HYD panel 245VU: open the guard and push the RAT MAN ON pushbutton switch to ON.

...

On the RAT stow panel:
-put the ON/OFF switch to ON.
-put and hold the LAMP TEST toggle switch to ON.
-release the LAMP TEST toggle switch to OFF.

RAT inspection

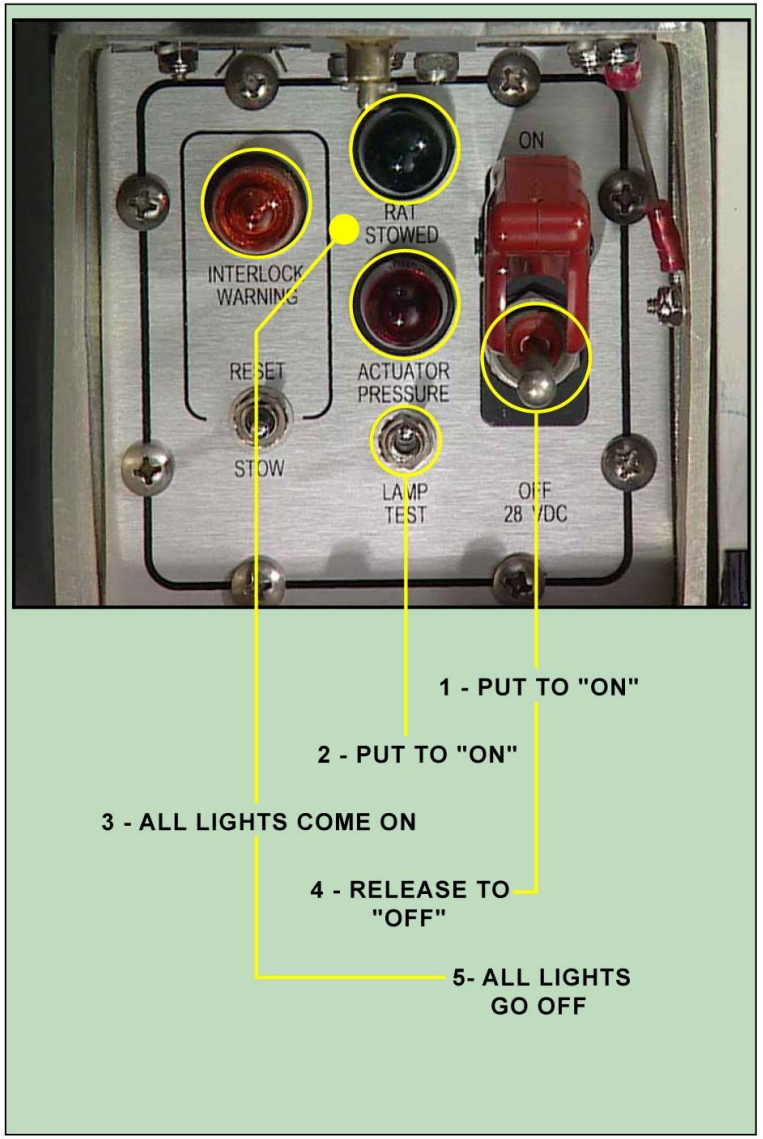
RAT retraction

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT EXTENSION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION (continued)

RAT INSPECTION

Inspect the turbine blades for damage. Pressurize the green hydraulic system with the electric pump.
Check that the RAT pump warming flow indicator is in "OUT" position.
Check the retraction interlock by turning the blades away from the index position. Select STOW on the RAT stow panel, then check the red RAT ACTUATOR PRESSURE light comes on. The RAT retraction stops at 10 degrees. Then the RAT goes back to the extended position and the amber INTERLOCK light comes on.

NOTE: If the RAT exceeds 15 degrees, release the STOW switch immediately to prevent damage.

Select RESET at the stow panel and check the interlock light goes off.

Operational Test of the RAT Manual Extension/Retraction

...
Job set-up
...

Make sure that the Green hydraulic system is depressurized.

...
Procedure
...

RAT extension

RAT inspection

At the RAT:
- inspect the turbine blades for damage.

Pressurize the Green hydraulic system with the electric pump.
At the RAT:
- check the RAT warming-flow indicator.
At the RAT:
- move the turbine blades away from the index position.
On the RAT stow panel:
- put and hold the STOW/RESET switch to STOW.
On the RAT stow panel:
- put the STOW/RESET switch to RESET and then release the switch to neutral.

RAT retraction

Stowed RAT inspection

...
Close-up
...

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

RAT inspection

✓ At the RAT:
- inspect the turbine blades for damage.

Pressurize the Green hydraulic system with the electric pump.
At the RAT:
- check the RAT warming-flow indicator.

At the RAT:
- move the turbine blades away from the index position.

On the RAT stow panel:
- put and hold the STOW/RESET switch to STOW.

On the RAT stow panel:
- put the STOW/RESET switch to RESET and then release the switch to neutral.

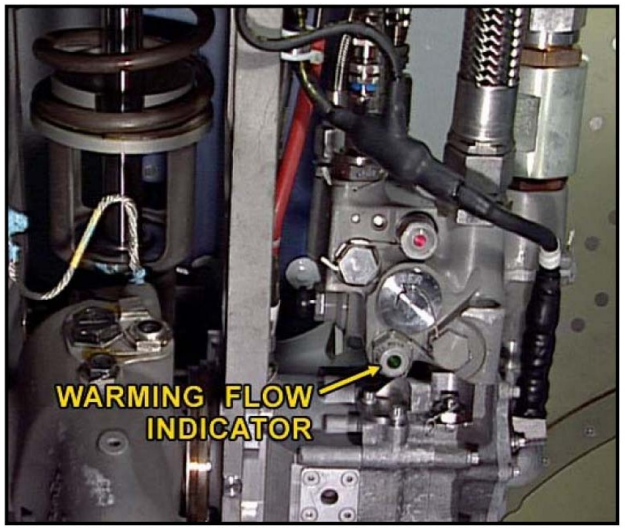
RAT retraction

Stowed RAT inspection

...

Close-up

...



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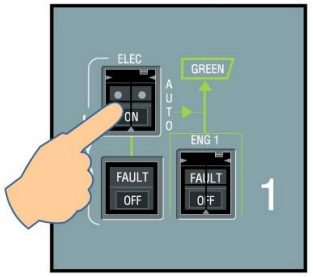


OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

Job set-up

...

Make sure that the Green hydraulic system is depressurized.

...

Procedure

...

RAT extension

RAT inspection

At the RAT:
- inspect the turbine blades for damage.

Pressurize the Green hydraulic system with the electric pump.

At the RAT:
- check the RAT warming-flow indicator.

At the RAT:
- move the turbine blades away from the index position.

On the RAT stow panel:
- put and hold the STOW/RESET switch to STOW.

On the RAT stow panel:
- put the STOW/RESET switch to RESET and then release the switch to neutral.

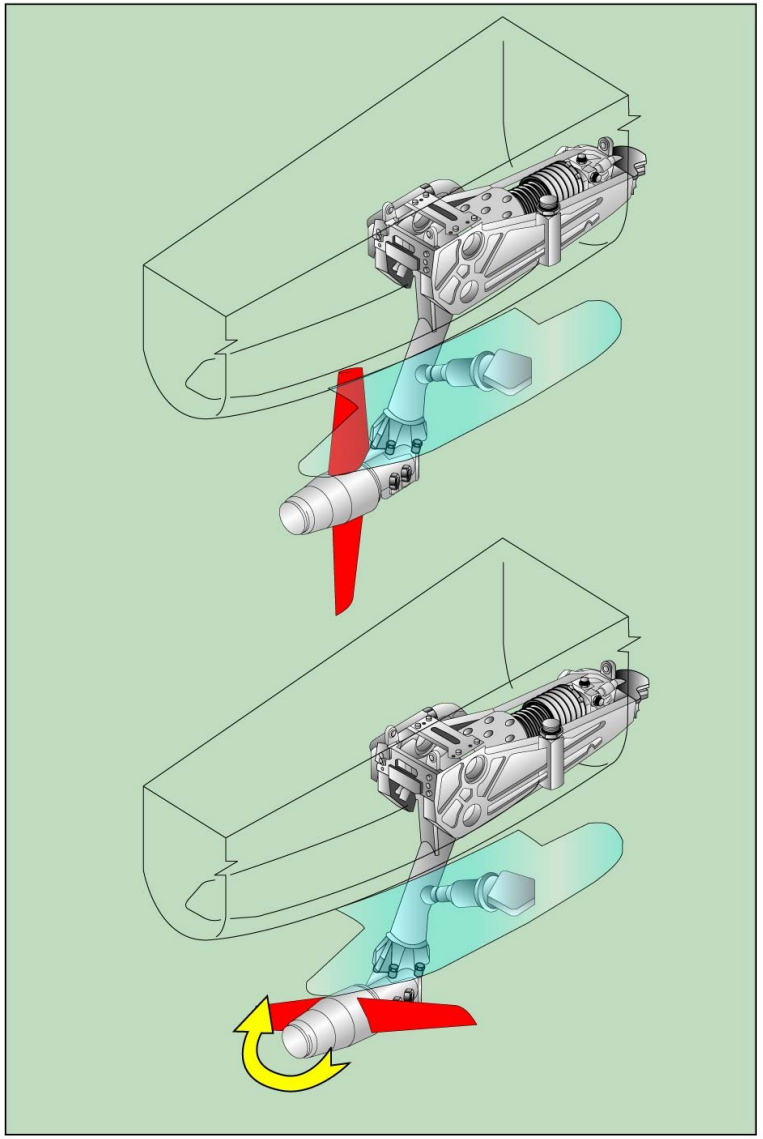
RAT retraction

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

Job set-up

...

Make sure that the Green hydraulic system is depressurized.

...

Procedure

...

RAT extension

RAT inspection

At the RAT:
- inspect the turbine blades for damage.

Pressurize the Green hydraulic system with the electric pump.

At the RAT:
- check the RAT warming-flow indicator.

At the RAT:
- move the turbine blades away from the index position.

On the RAT stow panel:
- put and hold the STOW/RESET switch to STOW.

On the RAT stow panel:
- put the STOW/RESET switch to RESET and then release the switch to neutral.

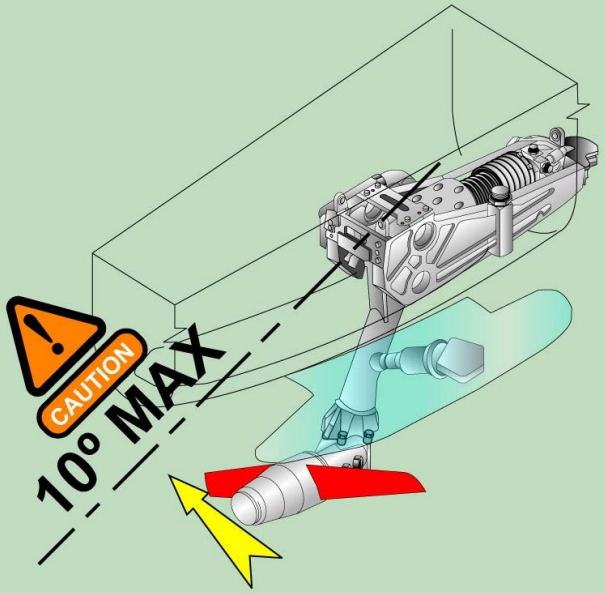
RAT retraction

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

Job set-up

...

Make sure that the Green hydraulic system is depressurized.

...

Procedure

...

RAT extension

RAT inspection

At the RAT:
- inspect the turbine blades for damage.

Pressurize the Green hydraulic system with the electric pump.

At the RAT:
- check the RAT warming-flow indicator.

At the RAT:
- move the turbine blades away from the index position.

On the RAT stow panel:
- put and hold the STOW/RESET switch to STOW.

On the RAT stow panel:
- put the STOW/RESET switch to RESET and then release the switch to neutral.

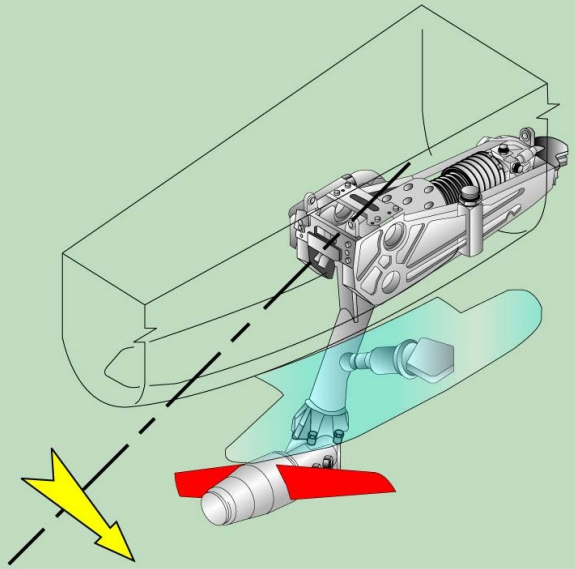
RAT retraction

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION (continued)

RAT RETRACTION

Align the turbine blades in the index position.
Select and hold STOW.
Confirm that the red ACTUATOR PRESSURE comes on. The RAT retracts in less than 30 seconds, then the green RAT STOWED light comes on as soon as the RAT reaches the fully stowed position. Also check on the ECAM that the RAT triangle indication changes from amber to white and the RAT fault message goes off.
Release the STOW switch and confirm the red ACTUATOR PRESSURE light cancels.
Set the ON/OFF switch to OFF, reset the guard and close the access panel.

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

✓ **RAT inspection**

RAT retraction

At the RAT:
-align the turbine blades in the index position.

On the RAT stow panel:
-put and hold the STOW/RESET switch to STOW.

On the RAT stow panel:
-release the STOW/RESET switch to neutral.

...

On the RAT stow panel, put the ON/OFF switch to OFF and the RAT STOWED light goes off.

...

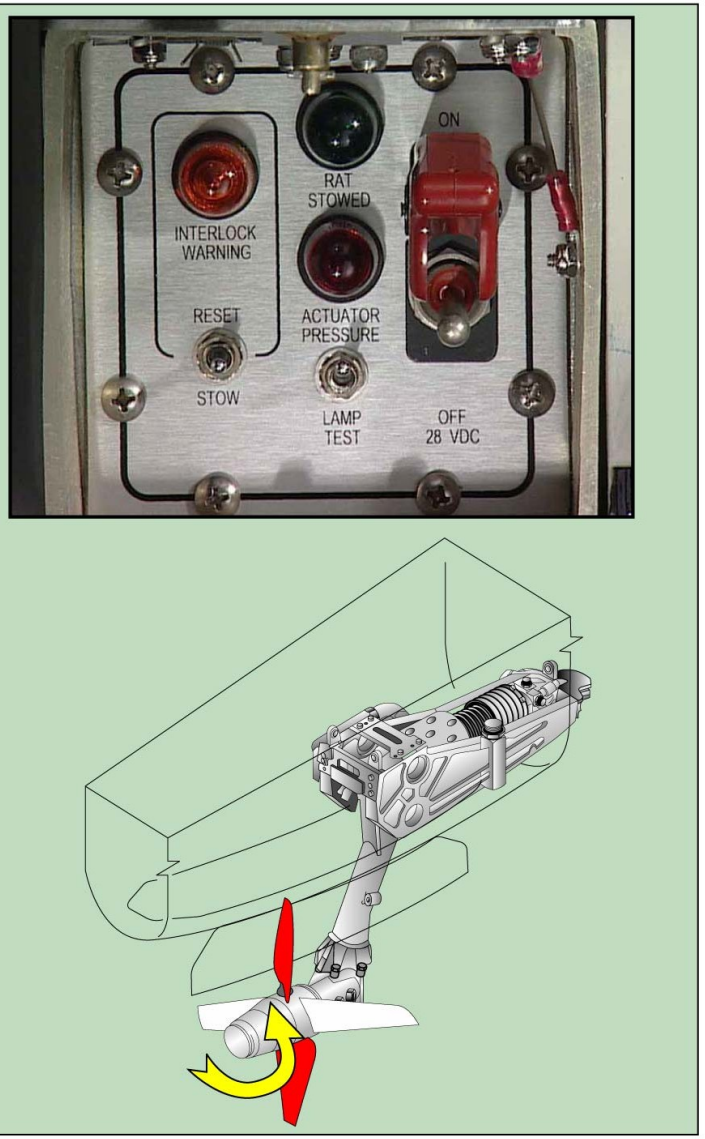
Close the RAT stow-panel access door.

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT RETRACTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

✓ **RAT inspection**

RAT retraction

✓ At the RAT:
-align the turbine blades in the index position.

On the RAT stow panel:
-put and hold the STOW/RESET switch to STOW.

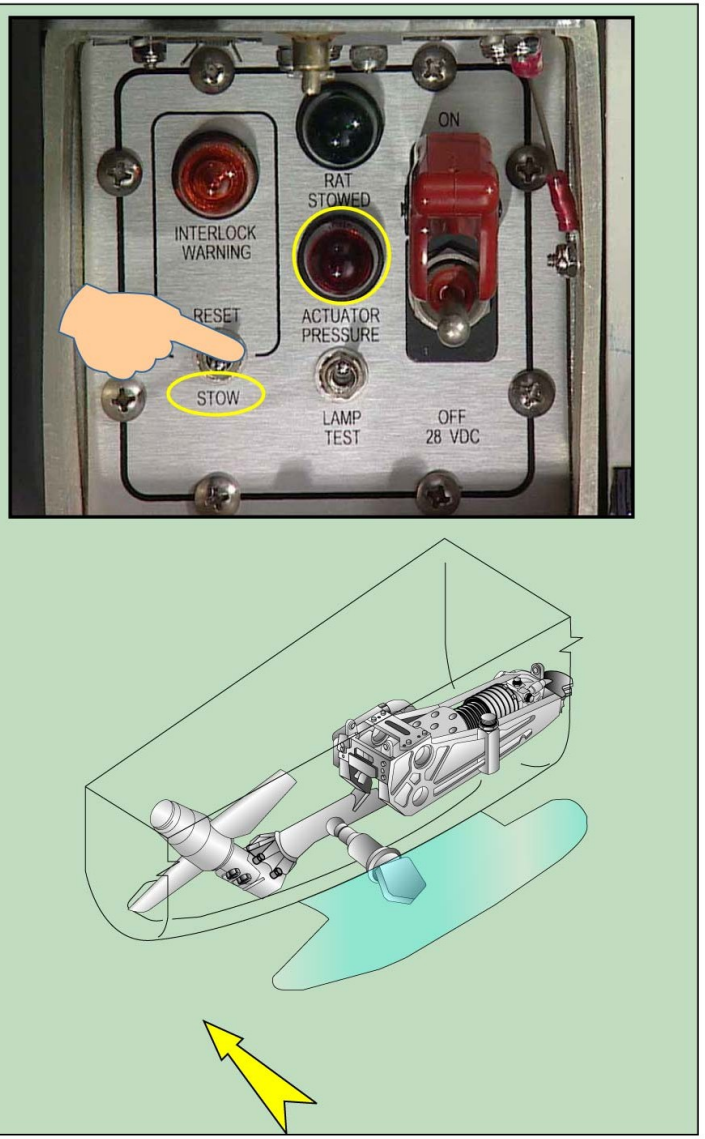
On the RAT stow panel:
-release the STOW/RESET switch to neutral.

...

On the RAT stow panel, put the ON/OFF switch to OFF and the RAT STOWED light goes off.

...

Close the RAT stow-panel access door.



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT RETRACTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

✓ **RAT inspection**

RAT retraction

✓ At the RAT:
-align the turbine blades in the index position.

On the RAT stow panel:
-put and hold the STOW/RESET switch to STOW.

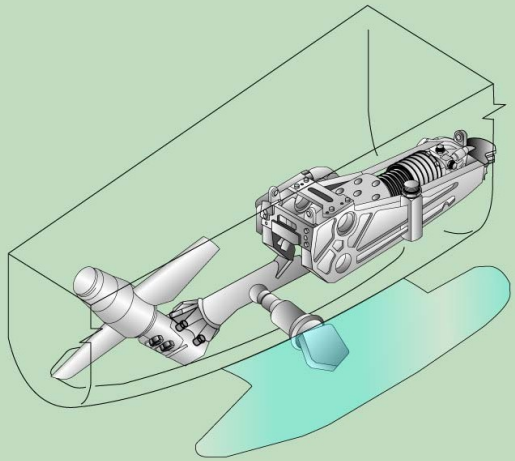
On the RAT stow panel:
-release the STOW/RESET switch to neutral.

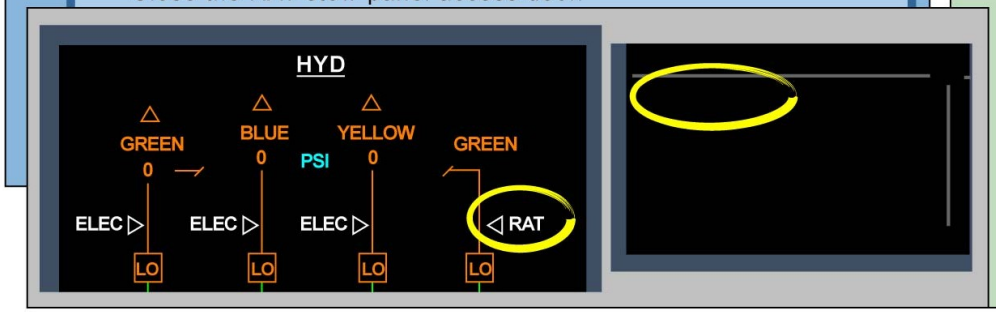
...

On the RAT stow panel, put the ON/OFF switch to OFF and the RAT STOWED light goes off.

...

Close the RAT stow-panel access door.





OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT RETRACTION

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

✓ **RAT inspection**

RAT retraction

✓ At the RAT:
-align the turbine blades in the index position.

✓ On the RAT stow panel:
-put and hold the STOW/RESET switch to STOW.

⇨ On the RAT stow panel:
-release the STOW/RESET switch to neutral.

...

On the RAT stow panel, put the ON/OFF switch to OFF and the RAT STOWED light goes off.

...

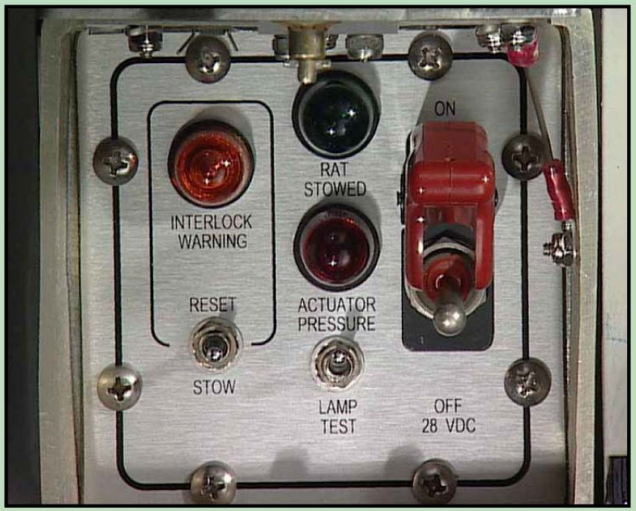
Close the RAT stow-panel access door.

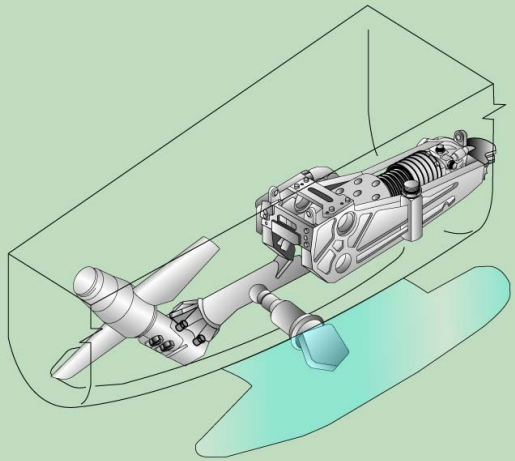
Stowed RAT inspection

...

Close-up

...





OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT RETRACTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

...

Procedure

...

✓ **RAT extension**

✓ **RAT inspection**

RAT retraction

✓ At the RAT:
-align the turbine blades in the index position.

✓ On the RAT stow panel:
-put and hold the STOW/RESET switch to STOW.

✓ On the RAT stow panel:
-release the STOW/RESET switch to neutral.

...

⇨ On the RAT stow panel, put the ON/OFF switch to OFF and the RAT STOWED light goes off.

...

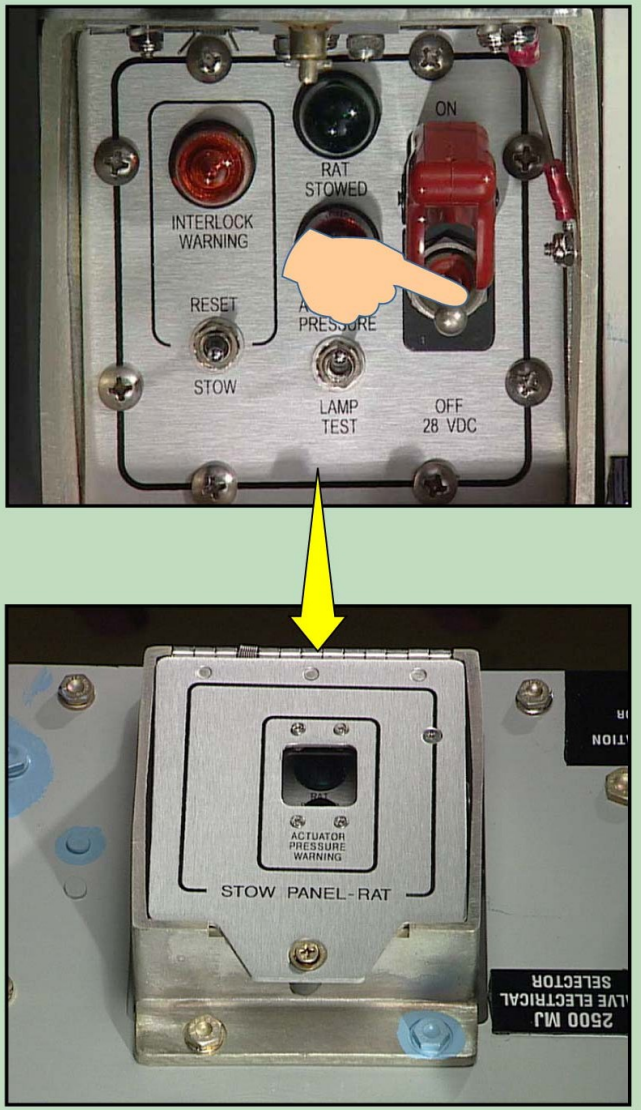
Close the RAT stow-panel access door.

Stowed RAT inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - RAT RETRACTION

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION (continued)

STOWED RAT INSPECTION

Install the RAT safety pin in the RAT.
Check the RAT Differential pressure indicator (Dpi) is in the "in" position, the RAT warming flow and the volumetric fuse are in the "out" position. Push the RAT volumetric fuse "in" and pull out again, check if it moves easily "in" and "out".
On the RAT PNL put to "off" and RAT STOWED light goes of.
Remove the safety pin before dispatch.
Clear the work area.

Operational Test of the RAT Manual Extension/Retraction

...
Job set-up
...

- ✓ **Make sure that the Green hydraulic system is depressurized.**

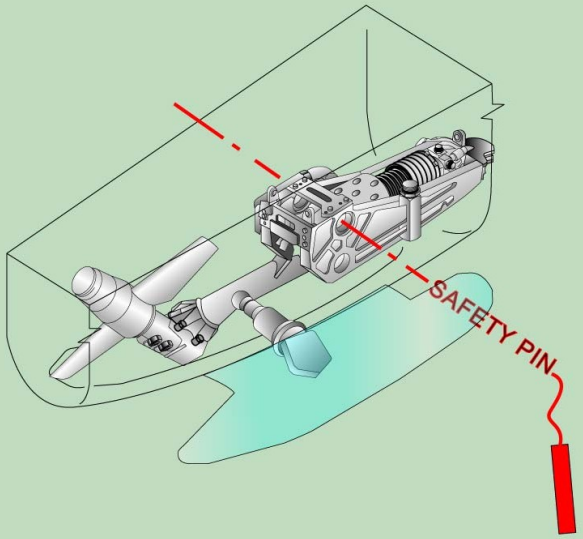
...
Procedure
...

- ✓ **RAT extension**
- ✓ **RAT inspection**
- ✓ **RAT retraction**

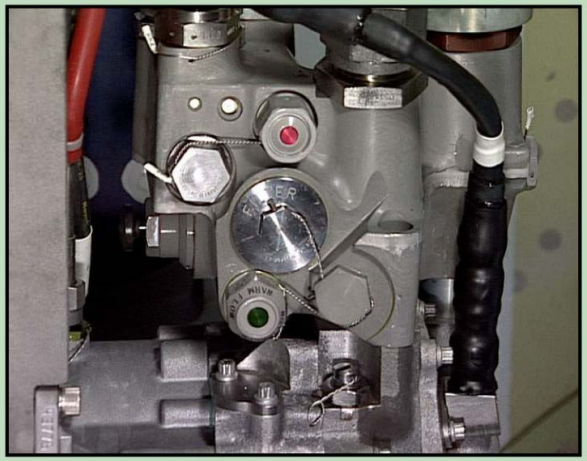
Stowed RAT inspection
...
⇨ Install the RAT SAFETY PIN in the RAT.
Inspect the RAT and make sure that the RAT differential pressure indicator is in the "in" position.
Volumetric fuse OUT.
Warming flow OUT.
Push RAT volumetric "IN" and pull out again.
...

...
Close-up
...

...
Close-up
...



RAT MANIFOLD



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - STOWED RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

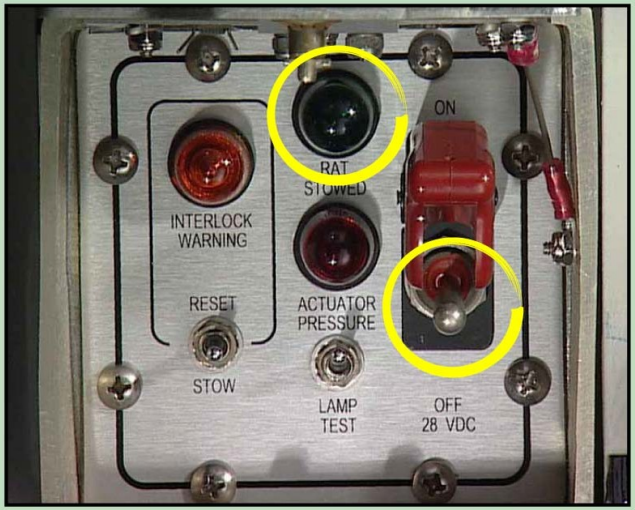
Operational Test of the RAT Manual Extension/Retraction

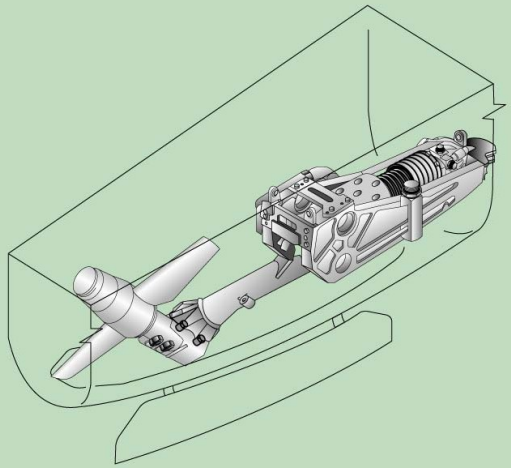
...
✓ **Job set-up**
...
✓ **Make sure that the Green hydraulic system is depressurized.**
...
Procedure
...
✓ **RAT extension**

✓ **RAT inspection**

✓ **RAT retraction**

✓ **Stowed RAT inspection**
...
⇨ Put to "OFF" on the RAT PNL and RAT STOWED light goes off
...
Remove the SAFETY PIN from the RAT
...
Close-up





OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - STOWED RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

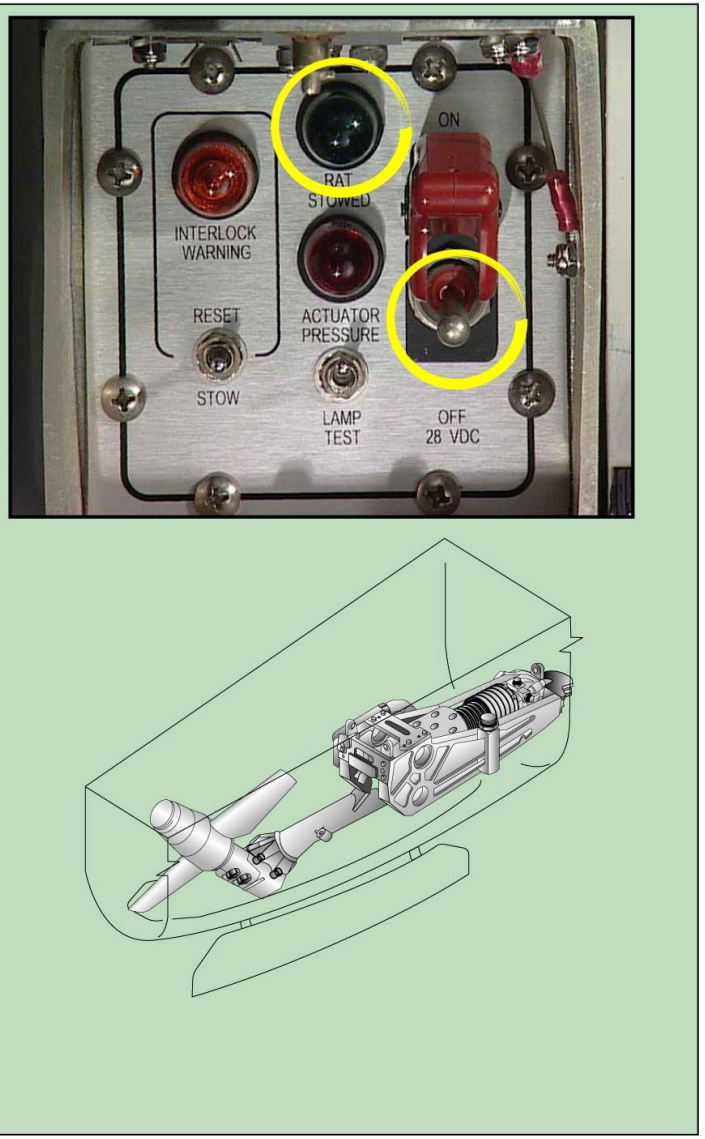
Operational Test of the RAT Manual Extension/Retraction

...
✓ **Job set-up**
...
✓ **Make sure that the Green hydraulic system is depressurized.**
...
Procedure
...
✓ **RAT extension**

✓ **RAT inspection**

✓ **RAT retraction**

✓ **Stowed RAT inspection**
...
✓ Put to "OFF" on the RAT PNL and RAT STOWED light goes off
...
⇨ Remove the SAFETY PIN from the RAT
...
Close-up



OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - STOWED RAT INSPECTION

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Extension/Retraction

...
✓ Job set-up
...
✓ Make sure that the Green hydraulic system is depressurized.
...
Procedure
...
✓ RAT extension
✓ RAT inspection
✓ RAT retraction
✓ Stowed RAT inspection
...
✓ Close-up
...

TASK COMPLETED

OPERATIONAL TEST OF THE RAT MANUAL EXTENSION/RETRACTION - STOWED RAT INSPECTION

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G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS

NOTE: This procedure can also be done without ACMS.
The following tests check the condition of the RAT manual actuation system and of the RAT itself.

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

Job set-up

...

Make sure that the Green hydraulic system is depressurized.

Set the leak measurement valves to OFF.

...

Procedure

Operational Test of the Manual RAT Deployment

...

Aircraft Maintenance Configuration

Installation of the Ground Support Equipment

Put the ACMS system in the operational condition

Spin-Up and Governing Test with the ACMS

Pump Test with the ACMS

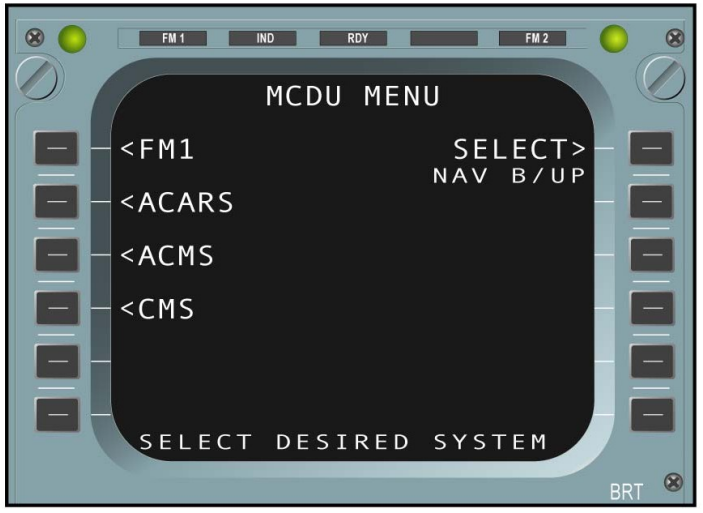
Anti-Stall Device Test with the ACMS

Inspection

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS (continued)

PRE-TEST SET-UP

Make sure the green hydraulic system is depressurized.
Prevent inadvertent operation of the flight controls by setting the LEAK MEASUREMENT VALVES to OFF.
Extend the RAT manually by pushing the RAT MAN ON pushbutton, but do not exceed 1 minute. Check on the ECAM the RAT triangle indication changes from white to amber and that the EWD RAT FAULT warning comes on. Monitor the actual RAT extension. At the RAT stow panel select the power ON and do the lamp test.
Manually push the RAT to the extended position and check if the down lock is fully engaged. Inspect the following items:
- RAT actuator spring,
- RAT doors and door spring struts,
- RAT and its components,
- RAT blades (damage limits quoted in AMM),
- RAT freedom to rotate,
- RAT interlock cable and index pin,

Push the RAT warming-flow indicator in the "IN" position and check if the RAT Dpi is also in the "IN" position.
Fit the RAT ground test motor to the RAT and connect it to the external hydraulic power unit, then fit the RAT protective equipment.
Select the ACMS line key on the MCDU. Select the SPECIAL FUNC/ REPROGRAMMING line key. Enter the level 2 password. Select the RAT TEST line key to get access to the ACMS RAT TEST ARMING menu.

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

Job set-up

...

✓ Make sure that the Green hydraulic system is depressurized.

⇨ Set the leak measurement valve G to OFF.

...

Procedure

Operational Test of the Manual RAT Deployment

...

Aircraft Maintenance Configuration

Installation of the Ground Support Equipment

Put the ACMS system in the operational condition

Spin-Up and Governing Test with the ACMS

Pump Test with the ACMS

Anti-Stall Device Test with the ACMS

Inspection

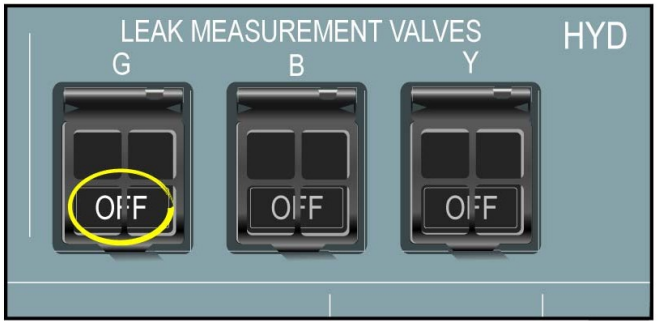
...

Close-up

...

GREEN HYD. SYSTEM DEPRESSURIZED

(285VU)



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

Operational Test of the Manual RAT Deployment

...

On the panel 245VU:
-lift the guard and push the RAT MAN ON pushbutton switch.

NOTE :A second person must check the extension of the RAT.

...
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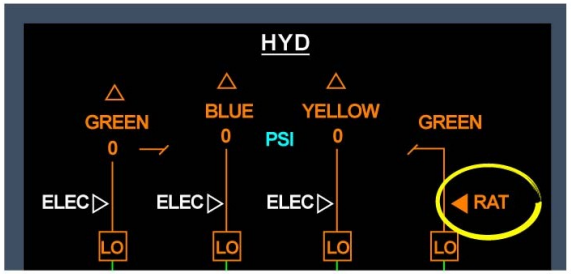
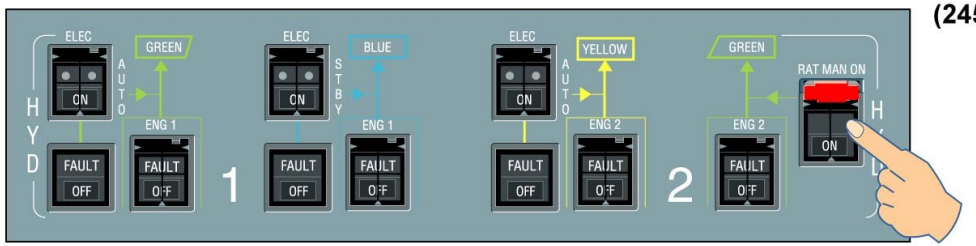
Close-up



A second person must check the extension of the RAT.



(245VU)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

Operational Test of the Manual RAT Deployment

...

On the panel 245VU:
-lift the guard and push the RAT MAN ON pushbutton switch.

NOTE :A second person must check the extension of the RAT.

...
...
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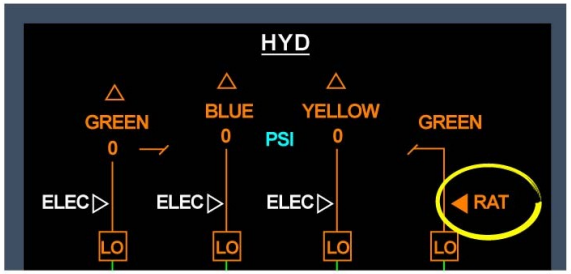
...
...

Close-up



A second person must check the extension of the RAT.

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

Aircraft Maintenance Configuration

Manually push the RAT in the retracted direction to make sure that the RAT actuator downlock is engaged.

Make sure that the RAT and the attachment parts are in the correct condition:

...

Check the oil level on the lower and upper gearboxes (the oil level is visible at the sight glass). If the oil level is not visible at the sight glass, add oil.

Manually turn the RAT blades to fine-pitch position against the spring pressure. Release quickly the blades and allow the spring pressure and momentum to push the blades towards the coarse-pitch position. Repeat this action three times and make sure that the blades return back to the stop at the full coarse-pitch position.

Setting of the RAT manifold Indicators:

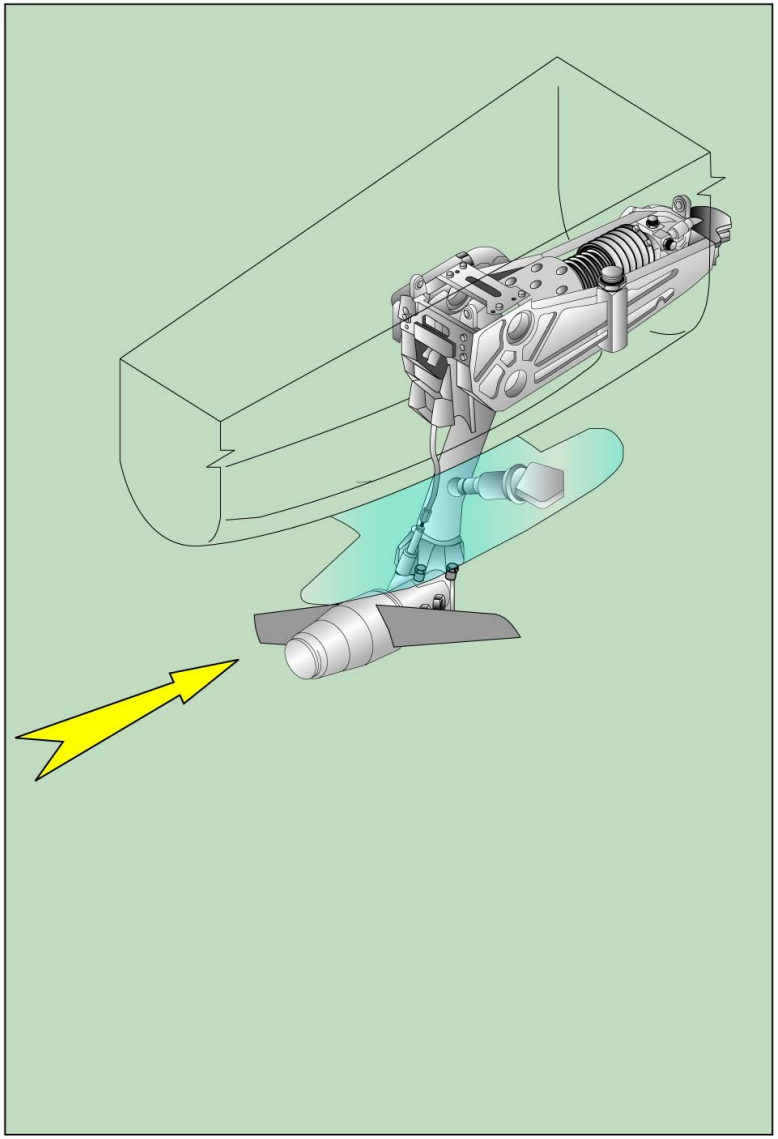
Make sure that the RAT differential-pressure indicator is in "in" position.

Set the RAT warming-flow indicator from the "out" to the "in" position.

Set the RAT manifold volumetric fuse indicator from the "out" to the "in" position.

...

Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

✓ Manually push the RAT in the retracted direction to make sure that the RAT actuator downlock is engaged.

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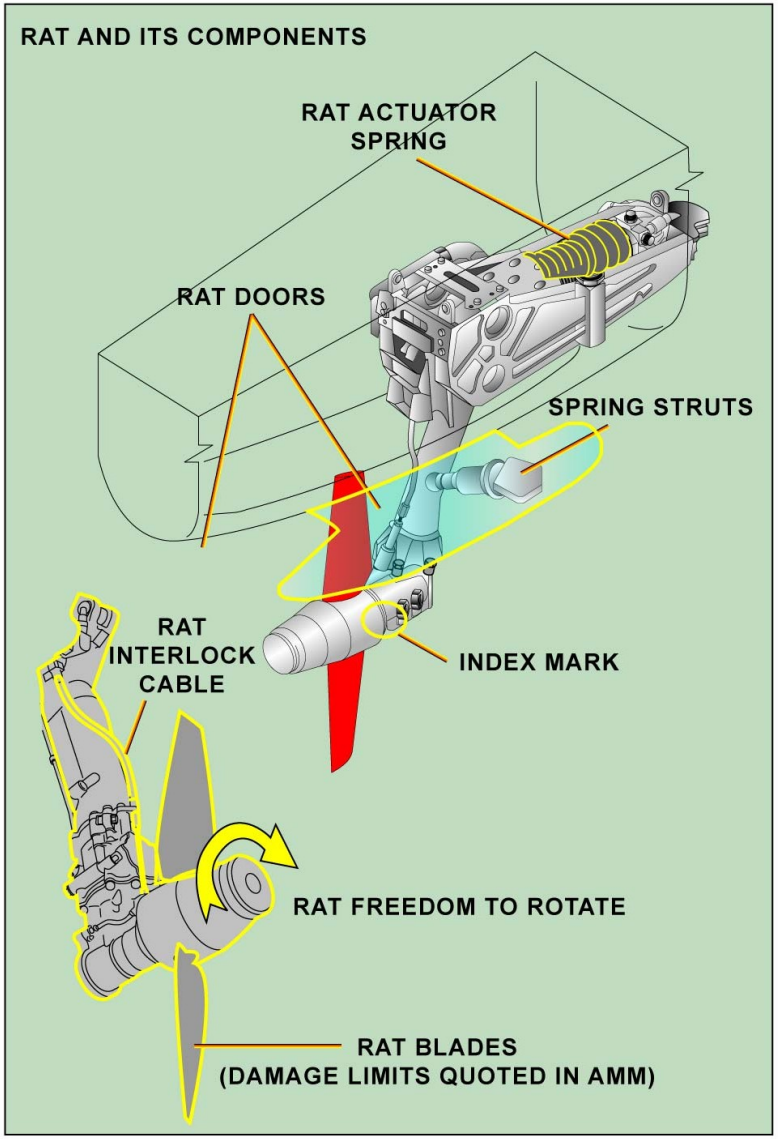
Set the RAT manifold volumetric fuse indicator from the "out" to the "in" position.

...

Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

Aircraft Maintenance Configuration

✓ Manually push the RAT in the retracted direction to make sure that the RAT actuator downlock is engaged.

✓ Make sure that the RAT and the attachment parts are in the correct condition:

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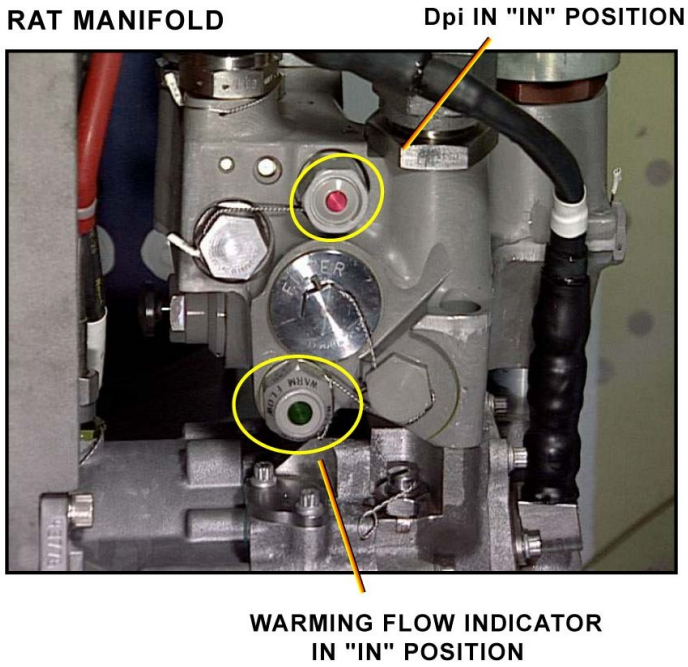
Set the RAT warming-flow indicator from the "out" to the "in" position.

Set the RAT manifold volumetric fuse indicator from the "out" to the "in" position.

...

Close-up

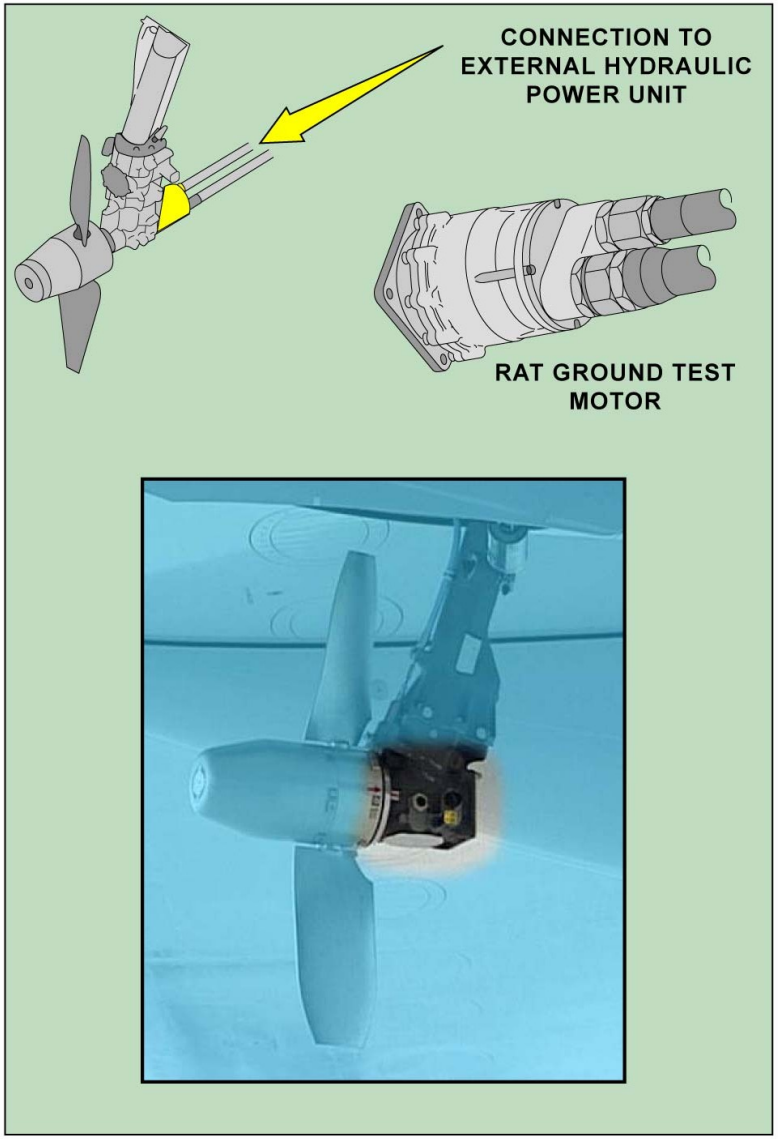


OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- ✓ Make sure that the Green hydraulic system is depressurized.
- ✓ Set the leak measurement valves to OFF.
- ...
- Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- **Installation of the Ground Support Equipment**
  - ...
  - Install the RAT ground test motor...
  - ...
  - Connect the hydraulic hoses to the external hydraulic power unit.
  - ...
  - Install the RAT PROTECTIVE EQUIPMENT.
  - ...
- ...
- Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

✓ **Aircraft Maintenance Configuration**

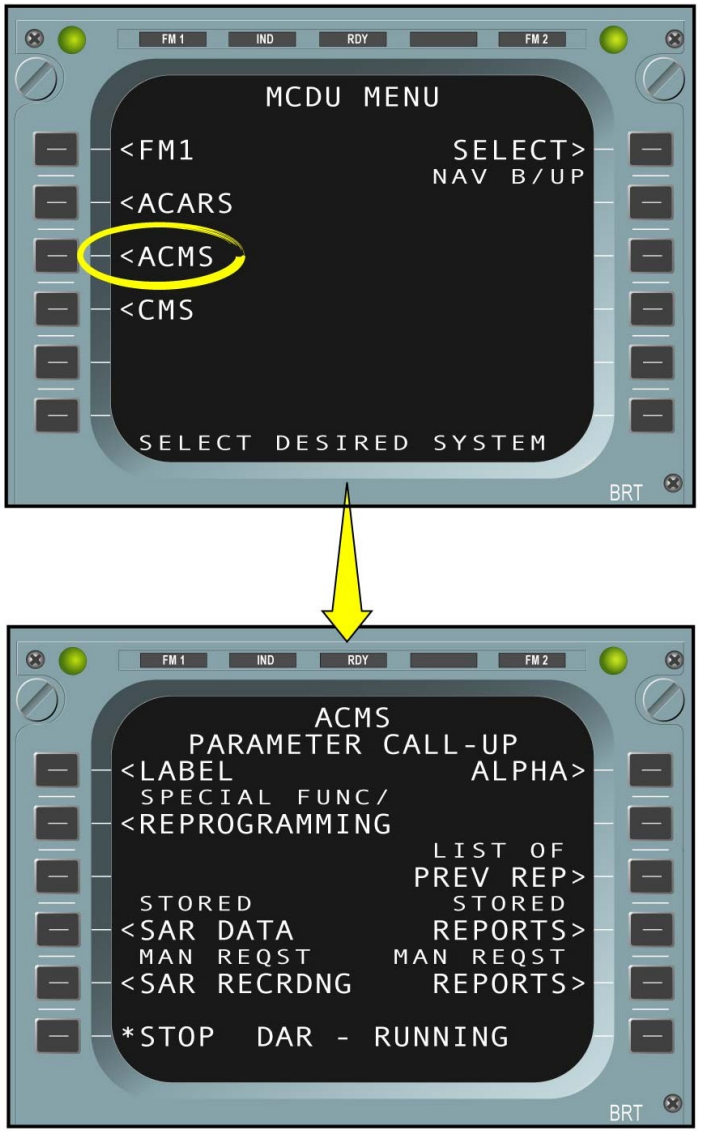
✓ **Installation of the Ground Support Equipment**

Put the ACMS system in the operation condition

On the MCDU menu:
-push the line key adjacent to the ACMS indication, the ACMS PARAMETER CALL-UP menu appears,
-push the line key adjacent to the SPECIAL FUNCT/ REPROGRAMMING indication, the ACMS: SPECIAL FUNC/ REPROG menu appears,
-enter the level 2 password,
-push the line key adjacent to the RAT TEST indication, the ACMS: RAT TEST ARMING menu appears.

...

Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

Put the ACMS system in the operation condition

On the MCDU menu:

✓ -push the line key adjacent to the ACMS indication, the ACMS PARAMETER CALL-UP menu appears,

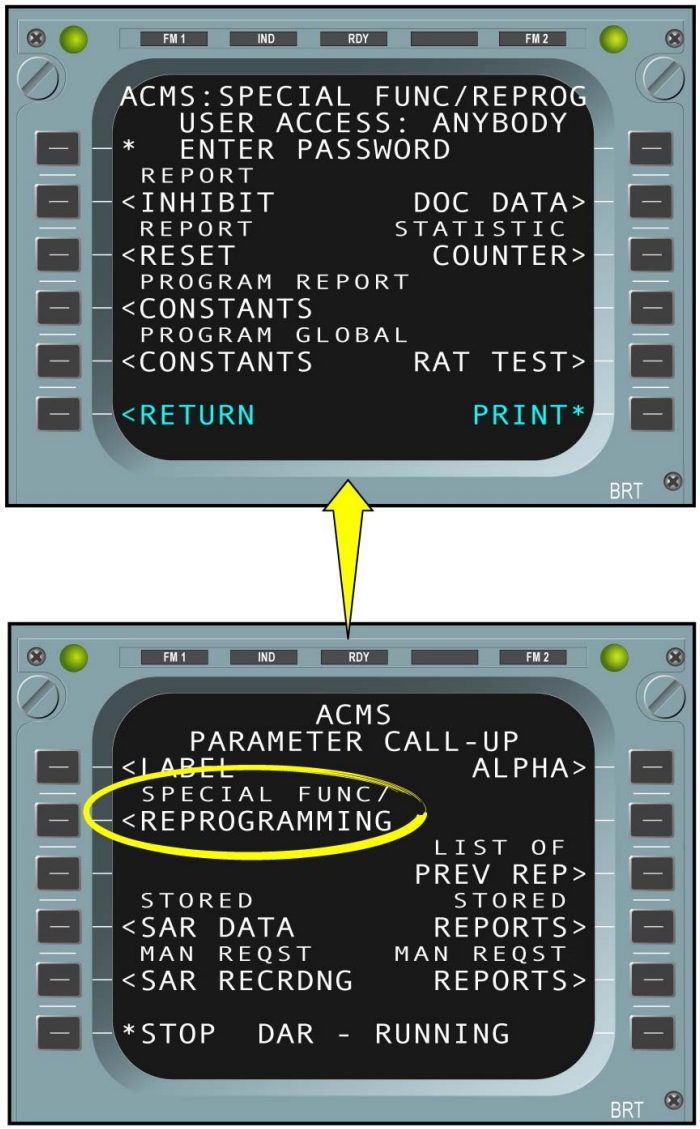
⇨ -push the line key adjacent to the SPECIAL FUNCT/ REPROGRAMMING indication, the ACMS: SPECIAL FUNC/ REPROG menu appears,

-enter the level 2 password,

-push the line key adjacent to the RAT TEST indication, the ACMS: RAT TEST ARMING menu appears.

...

Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**

...

✓ **Make sure that the Green hydraulic system is depressurized.**

✓ **Set the leak measurement valves to OFF.**

...

Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

Put the ACMS system in the operation condition

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✓ -push the line key adjacent to the ACMS indication, the ACMS PARAMETER CALL-UP menu appears,

-push the line key adjacent to the SPECIAL FUNCT/

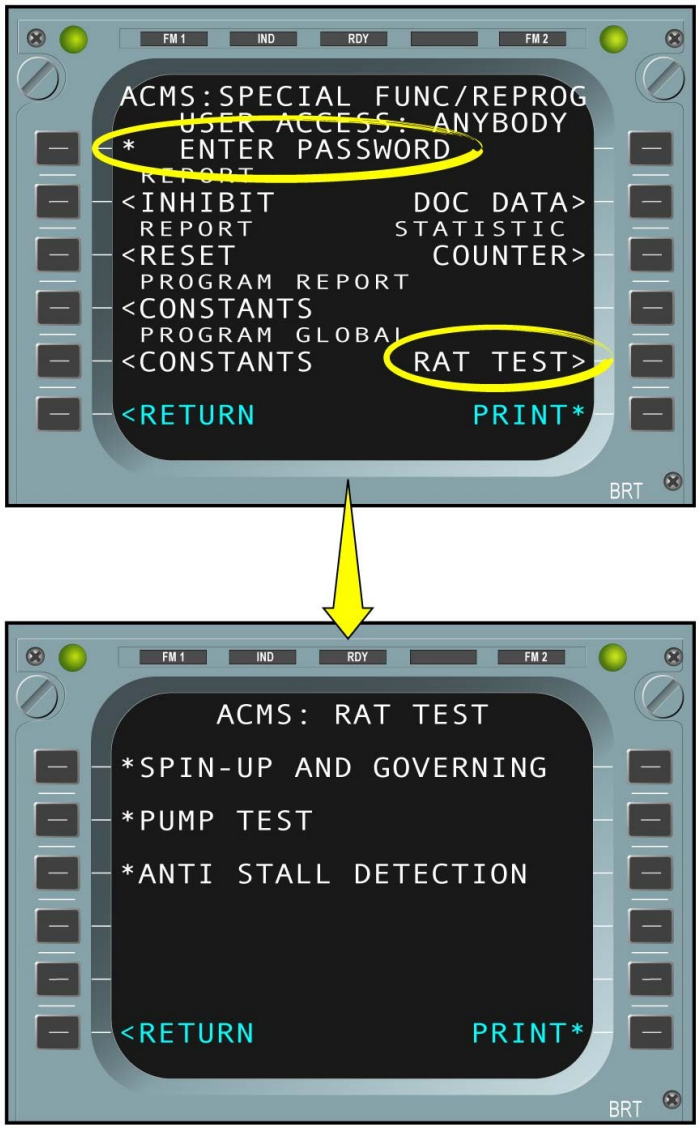
✓ REPROGRAMMING indication, the ACMS: SPECIAL FUNC/ REPROG menu appears,

-enter the level 2 password,

⇨ -push the line key adjacent to the RAT TEST indication, the ACMS: RAT TEST ARMING menu appears.

...

Close-up



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PRE-TEST SET-UP

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RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS (continued)

SPIN-UP AND GOVERNING TEST

Pressurize the green hydraulic system with the ELEC pump and check that the RAT blades do not move. The RAT symbol remains amber on the ECAM display.
On the MCDU select the SPIN-UP AND GOVERNING line key, the remaining arming time will be displayed.

NOTE: The next step must be done within 5 minutes or the procedure has to be started all over again.

On the external hydraulic unit, supply a pressure of 3000 psi at a maximum flow of 120 l/min. Check the RAT turns at around 5100 rpm and its ECAM symbol changes to green.
On the MCDU, select RETURN twice to display the ACMS PARAMETER CALL UP menu. Select the STORED REPORTS line key, then the LAST STORED REPORTS line key. The RAT Test Report is printed out and shows:
- "TEST CONDITION OK",
- "SPIN UP TEST OK",
- "GOVERNING TEST OK".

Select RETURN to display the ACMS PARAMETER CALL UP menu.

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

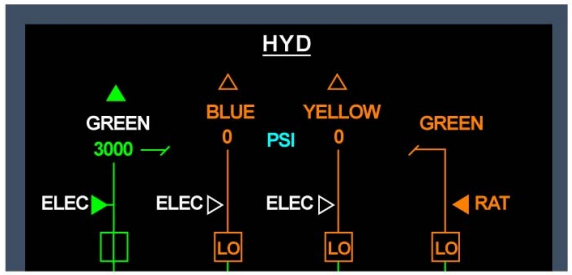
✓ **Installation of the Ground Support Equipment**

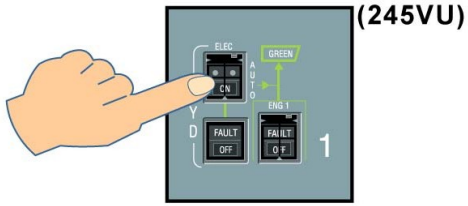
✓ **Put the ACMS system in the operation condition**

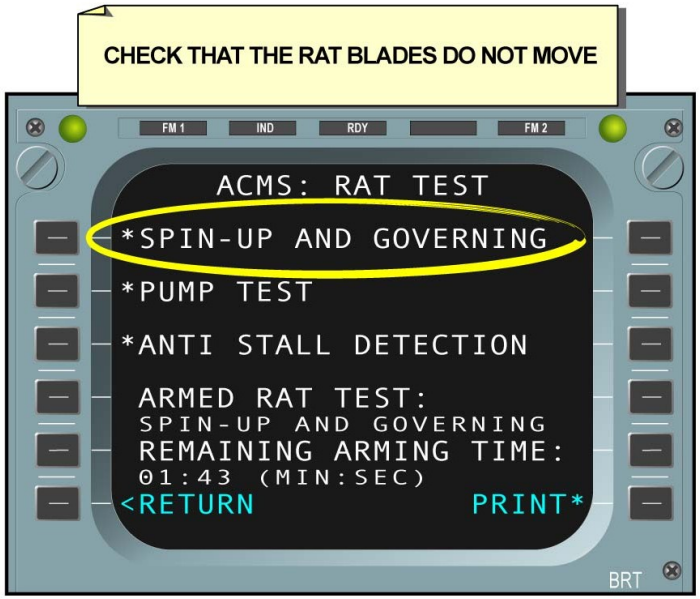
Spin-Up and Governing Test with the ACMS

On the ECAM control panel:
✓ -push the HYD key.
Pressurize the Green hydraulic system with the electric pump.
On the MCDU:
⇨ -push the line key adjacent to the SPIN-UP AND GOVERNING indication.
...
On the hydraulic ground-power cart:
...
-supply a pressure of approx. 206 bar (2987 psi) and more than 120 l.min (31 USgal.mn) to the RAT ground test motor within 3 seconds.
...
On the MCDU:
...

...
Close-up
...







OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**

...

✓ **Aircraft Maintenance Configuration**

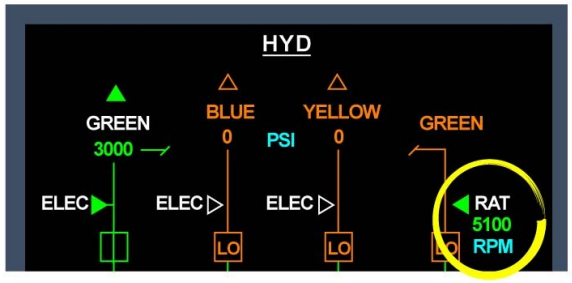
✓ **Installation of the Ground Support Equipment**

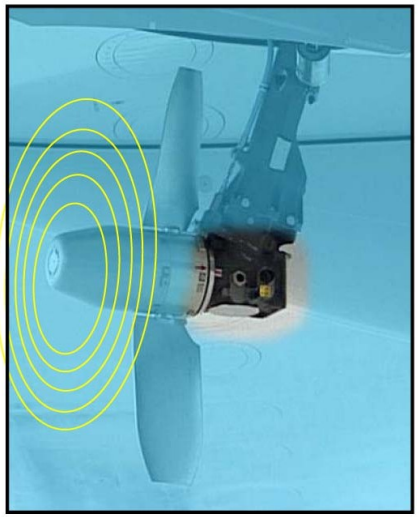
✓ **Put the ACMS system in the operation condition**

Spin-Up and Governing Test with the ACMS

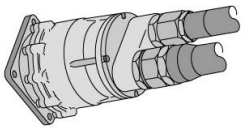
On the ECAM control panel:
✓ -push the HYD key.
Pressurize the Green hydraulic system with the electric pump.
On the MCDU:
✓ -push the line key adjacent to the SPIN-UP AND GOVERNING indication.
...
On the hydraulic ground-power cart:
...
⇨ -supply a pressure of approx. 206 bar (2987 psi) and more than 120 l.min (31 USgal.mn) to the RAT ground test motor within 3 seconds.
...
On the MCDU:
...

...
Close-up
...





EXTERNAL HYDRAULIC UNIT SUPPLY



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

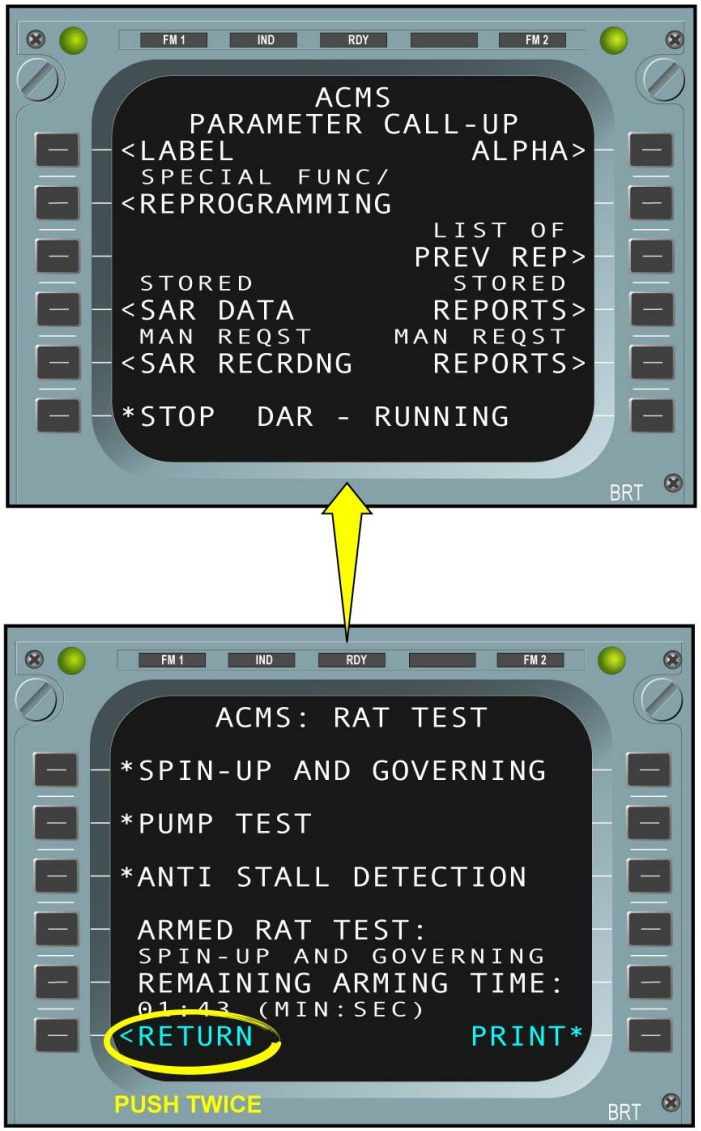
✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

Spin-Up and Governing Test with the ACMS

On the ECAM control panel:
✓ -push the HYD key.
Pressurize the Green hydraulic system with the electric pump.
On the MCDU:
✓ -push the line key adjacent to the SPIN-UP AND GOVERNING indication.
...
✓ On the hydraulic ground-power cart:
...
⇨ On the MCDU:
-push the line key adjacent to the RETURN indication twice.
-push the line key adjacent to the STORED REPORTS indication.
-push the line key adjacent to the LAST STORED REPORTS.
-push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

Spin-Up and Governing Test with the ACMS

On the ECAM control panel:
✓ -push the HYD key.
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✓ On the MCDU:
-push the line key adjacent to the RETURN indication twice.
➡ -push the line key adjacent to the STORED REPORTS indication.
-push the line key adjacent to the LAST STORED REPORTS.
-push the line key adjacent to the RETURN indication.

...
Close-up
...

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

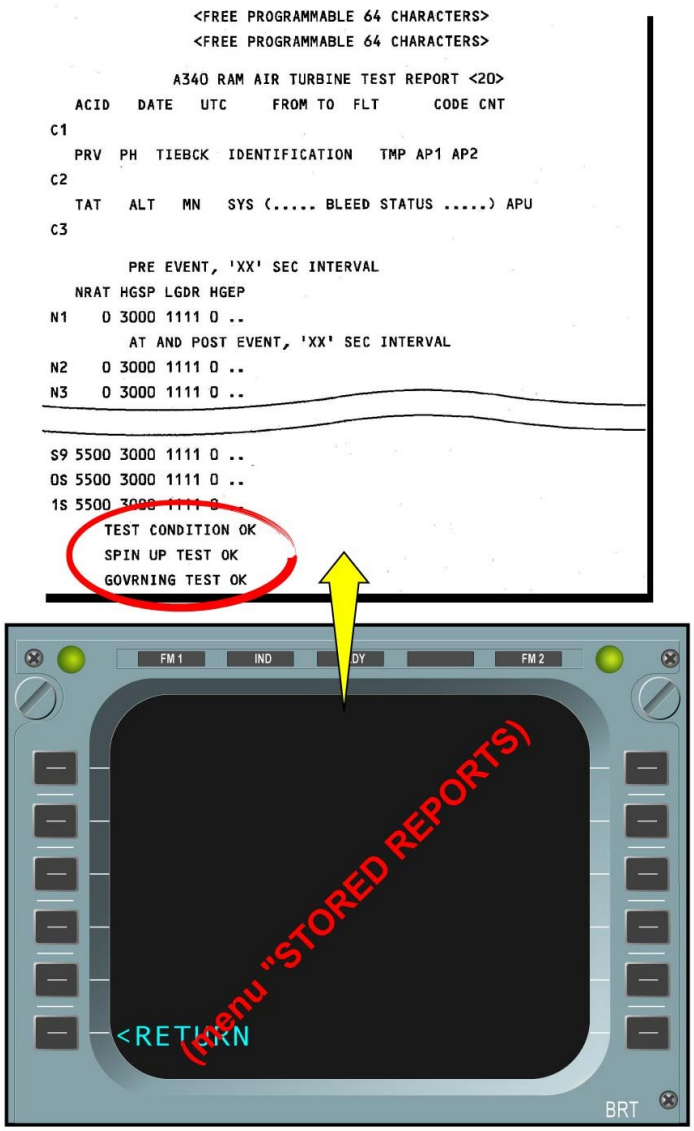
✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

Spin-Up and Governing Test with the ACMS

On the ECAM control panel:
✓ -push the HYD key.
Pressurize the Green hydraulic system with the electric pump.
On the MCDU:
✓ -push the line key adjacent to the SPIN-UP AND GOVERNING indication.
...
✓ On the hydraulic ground-power cart:
...
✓ On the MCDU:
-push the line key adjacent to the RETURN indication twice.
✓ -push the line key adjacent to the STORED REPORTS indication.
⇨ -push the line key adjacent to the LAST STORED REPORTS.
-push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

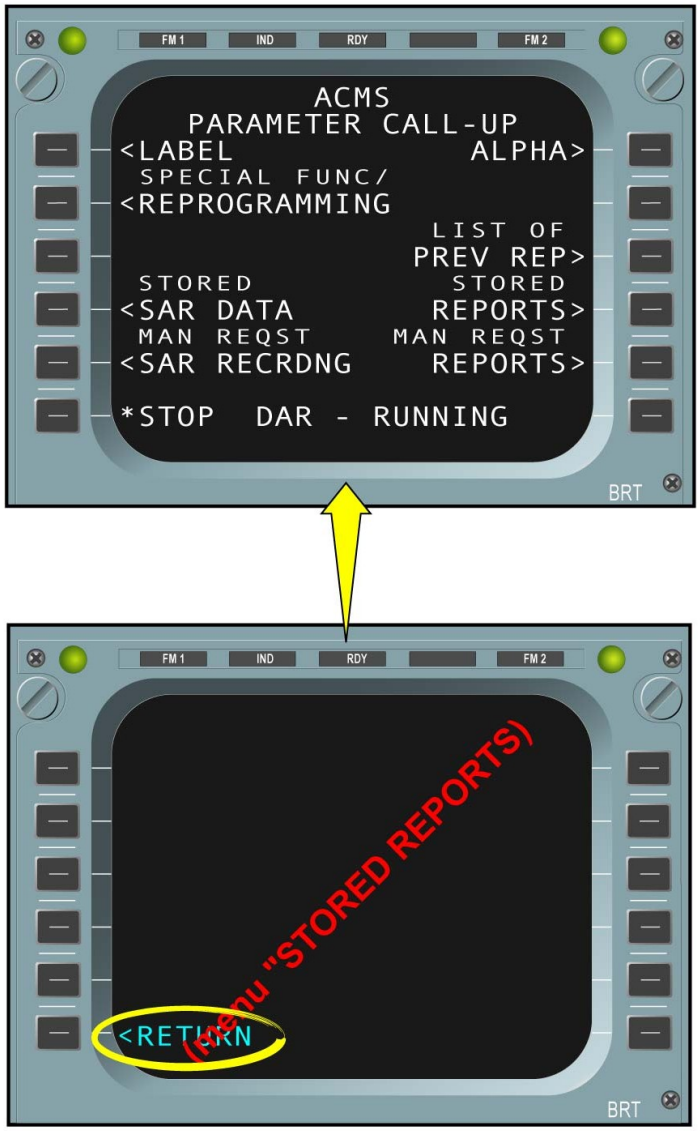
✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

Spin-Up and Governing Test with the ACMS

On the ECAM control panel:
✓ -push the HYD key.
Pressurize the Green hydraulic system with the electric pump.
On the MCDU:
✓ -push the line key adjacent to the SPIN-UP AND GOVERNING indication.
...
✓ On the hydraulic ground-power cart:
...
✓ On the MCDU:
-push the line key adjacent to the RETURN indication twice.
✓ -push the line key adjacent to the STORED REPORTS indication.
✓ -push the line key adjacent to the LAST STORED REPORTS.
⇨ -push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - SPIN-UP AND GOVERNING TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

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G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS (continued)

PUMP TEST

Depressurize the green hydraulic system.
On the MCDU, get access to the ACMS RAT TEST menu as you did for the SPIN-UP AND GOVERNING TEST and then select the PUMP TEST line key.
Close the LH side MLG door.
On the MCDU, get access to the last stored report as you did for the SPIN-UP AND GOVERNING TEST to obtain a printout as soon as the LH MLG door is locked.
"TEST CONDITION OK"
"PUMP TEST OK"
Select RETURN to display the ACMS PARAMETER CALL UP menu.

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ Job set-up
...
Procedure

✓ Operational Test of the Manual RAT Deployment
...

✓ Aircraft Maintenance Configuration

✓ Installation of the Ground Support Equipment

✓ Put the ACMS system in the operation condition

✓ Spin-Up and Governing Test with the ACMS

Pump Test with the ACMS

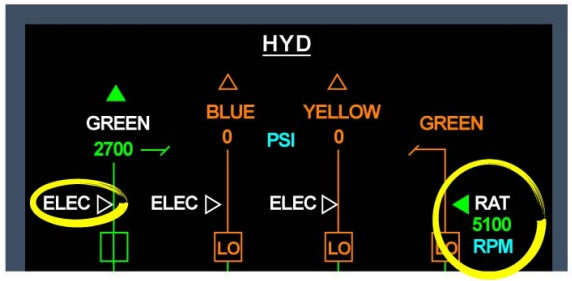
✓ Depressurize the Green hydraulic system with the electric pump.

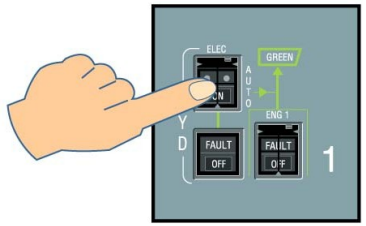
On the MCDU:
...
-push the line key adjacent to the PUMP TEST indication.

On the MLG control panel:
-set the LH MLG door handle in the closed position.

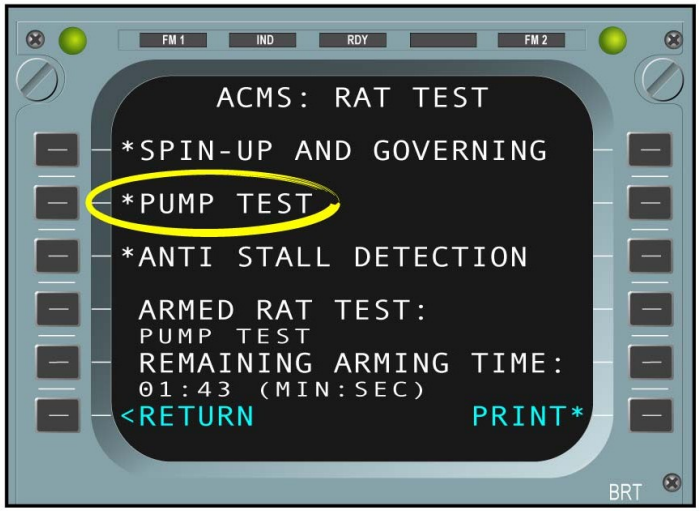
On the MCDU:
...
-push the line key adjacent to the LAST STORED REPORTS.
-push the line key adjacent to the RETURN indication.

...
Close-up
...





(245VU)



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PUMP TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

✓ **Spin-Up and Governing Test with the ACMS**

Pump Test with the ACMS

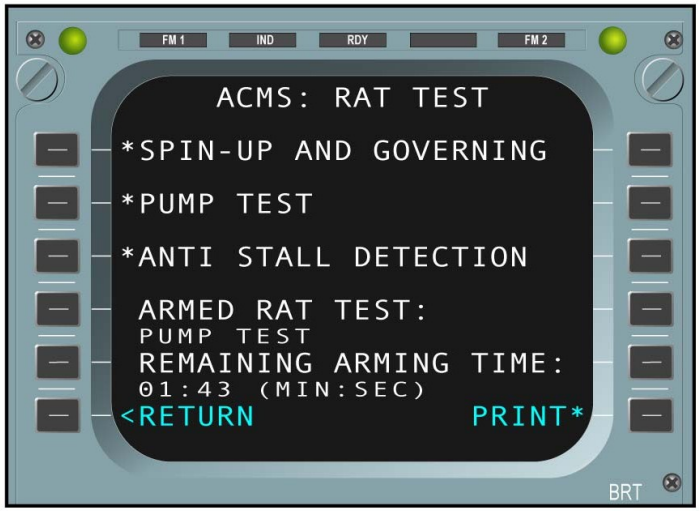
✓ Depressurize the Green hydraulic system with the electric pump.

✓ On the MCDU:
...
-push the line key adjacent to the PUMP TEST indication.

⇨ On the MLG control panel:
-set the LH MLG door handle in the closed position.

On the MCDU:
...
-push the line key adjacent to the LAST STORED REPORTS.
-push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PUMP TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

✓ **Spin-Up and Governing Test with the ACMS**

Pump Test with the ACMS

✓ Depressurize the Green hydraulic system with the electric pump.

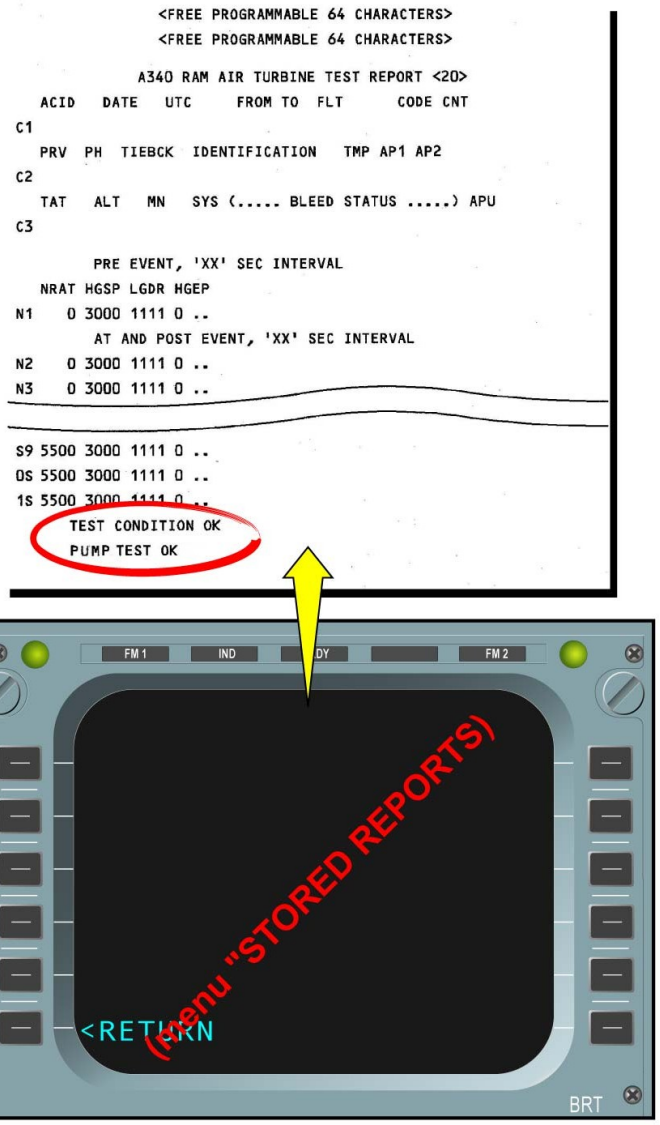
✓ On the MCDU:
...
-push the line key adjacent to the PUMP TEST indication.

✓ On the MLG control panel:
-set the LH MLG door handle in the closed position.

⇨ On the MCDU:
...
-push the line key adjacent to the LAST STORED REPORTS.

-push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PUMP TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

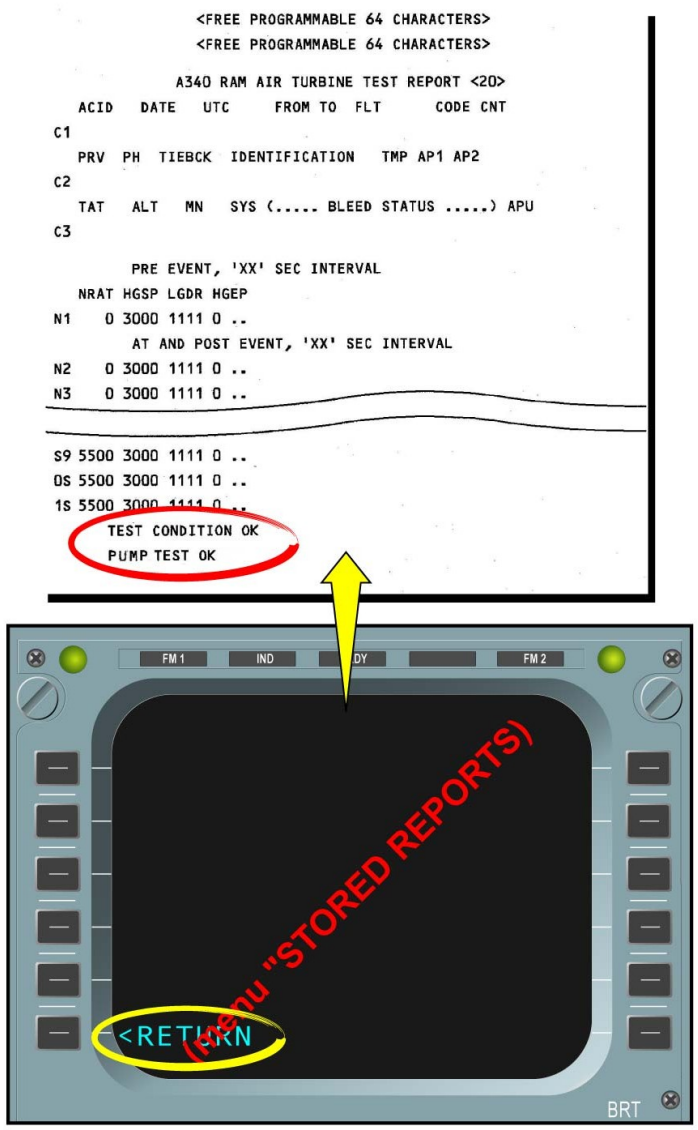
Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- ✓ Installation of the Ground Support Equipment
- ✓ Put the ACMS system in the operation condition
- ✓ Spin-Up and Governing Test with the ACMS

Pump Test with the ACMS

- ✓ Depressurize the Green hydraulic system with the electric pump.
- ✓ On the MCDU:
- ...
- -push the line key adjacent to the PUMP TEST indication.
- ✓ On the MLG control panel:
- -set the LH MLG door handle in the closed position.
- On the MCDU:
- ...
- ✓ -push the line key adjacent to the LAST STORED REPORTS.
- ⇨ -push the line key adjacent to the RETURN indication.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - PUMP TEST

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G9409341 - GAUT0T0 - FM29Y2LINEMCE03

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS (continued)

ANTI-STALL DEVICE TEST

Reduce the hydraulic ground cart pressure to obtain a RAT speed of 4500 rpm (typically max. 2610 psi).
On the MCDU, get access to the ACMS RAT TEST menu as you did for the SPIN-UP AND GOVERNING TEST and then select the ANTI STALL DETECTION line key.
Close the RH MLG door.
On the MCDU, get access to the last stored report as you did for the SPIN-UP AND GOVERNING TEST to obtain a printout as soon as the RH LG door is locked.
"TEST CONDITION OK"
"ANTI STALL DEVICE TEST OK"
Select RETURN twice to display the MCDU main menu.
Depressurize the external hydraulic supply and remove the RAT protective equipment and the RAT ground test motor from the RAT assembly.

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

✓ **Put the ACMS system in the operation condition**

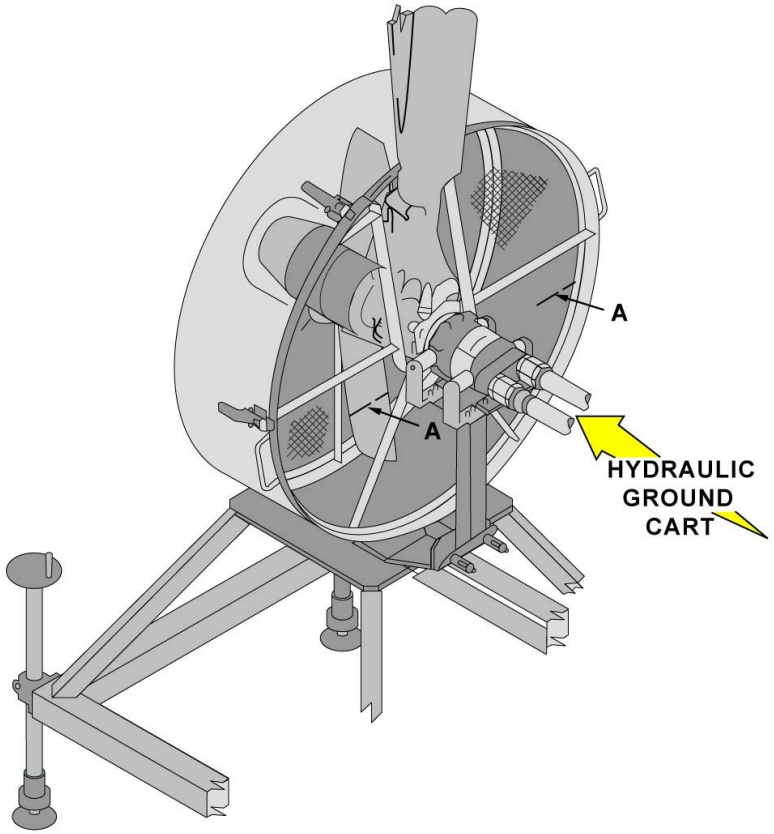
✓ **Spin-Up and Governing Test with the ACMS**

✓ **Pump Test with the ACMS**

Anti-Stall Device Test with the ACMS

On the hydraulic ground-power cart:
-decrease the hydraulic pressure to get a RAT speed of 4500 +/- 100 rpm.
On the MCDU:
...
-push the line key adjacent to the ANTI STALL DETECTION indication.
On the MLG control panel:
...

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - ANTI-STALL DEVICE TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ Job set-up
...
Procedure

✓ Operational Test of the Manual RAT Deployment
...

✓ Aircraft Maintenance Configuration

✓ Installation of the Ground Support Equipment

✓ Put the ACMS system in the operation condition

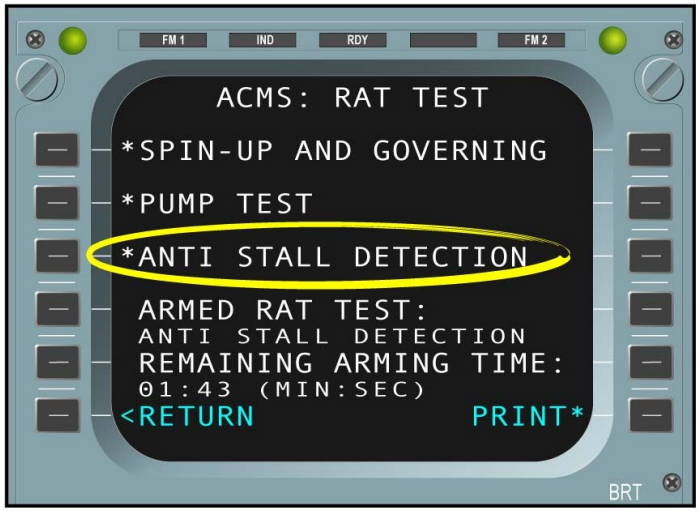
✓ Spin-Up and Governing Test with the ACMS

✓ Pump Test with the ACMS

Anti-Stall Device Test with the ACMS

✓ On the hydraulic ground-power cart:
...
✓ On the MCDU:
...
⇨ On the MLG control panel:
-set the RH MLG door handle in the closed position.
On the MCDU:
...
-push the line key adjacent to the last stored report.

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - ANTI-STALL DEVICE TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

✓ **Job set-up**
...
Procedure

✓ **Operational Test of the Manual RAT Deployment**
...

✓ **Aircraft Maintenance Configuration**

✓ **Installation of the Ground Support Equipment**

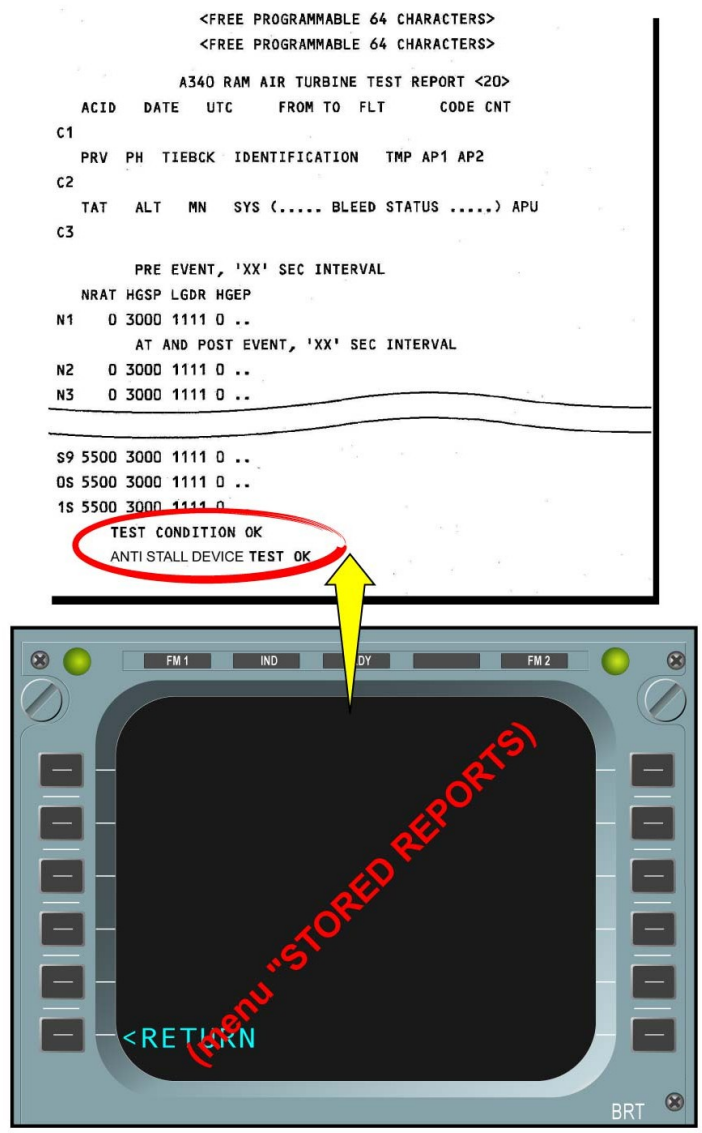
✓ **Put the ACMS system in the operation condition**

✓ **Spin-Up and Governing Test with the ACMS**

✓ **Pump Test with the ACMS**

Anti-Stall Device Test with the ACMS
- ✓ On the hydraulic ground-power cart: ...
- ✓ On the MCDU: ...
- ✓ On the MLG control panel: ...
- ⇨ On the MCDU:
  ...
  -push the line key adjacent to the last stored report.
  On the MCDU:
  -push the line key adjacent to the RETURN indication twice.
  ...

...
Close-up
...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - ANTI-STALL DEVICE TEST

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- ✓ Installation of the Ground Support Equipment
- ✓ Put the ACMS system in the operation condition
- ✓ Spin-Up and Governing Test with the ACMS
- ✓ Pump Test with the ACMS

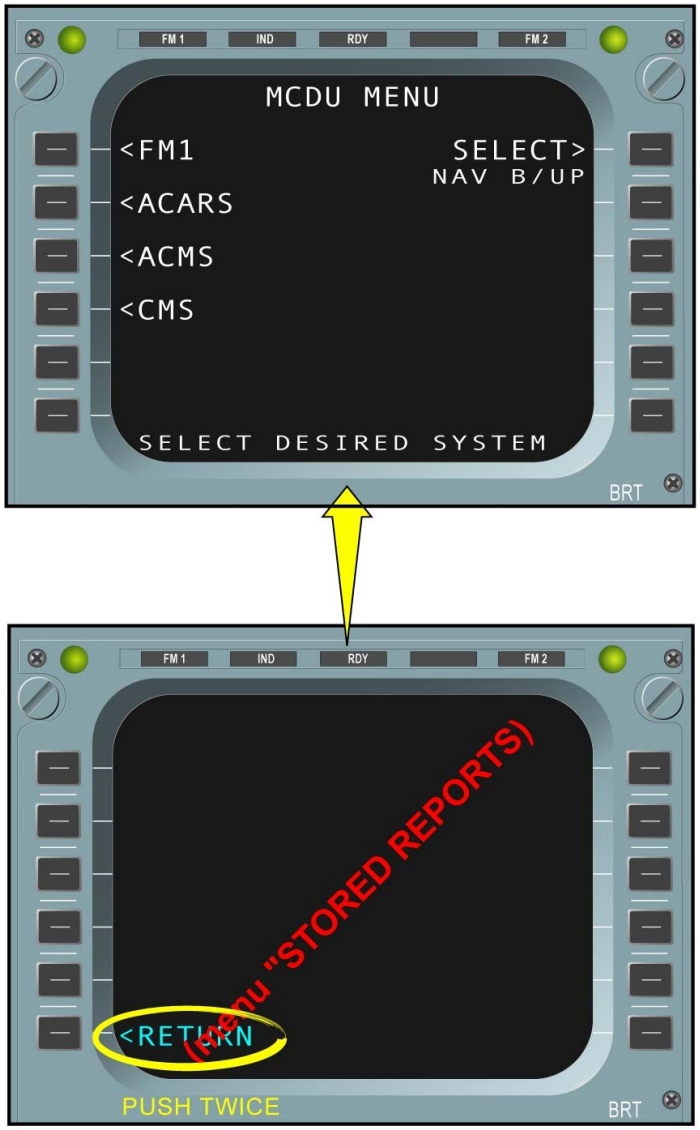
Anti-Stall Device Test with the ACMS

- ✓ On the hydraulic ground-power cart: ...
- ✓ On the MCDU: ...
- ✓ On the MLG control panel: ...
- ✓ On the MCDU: ...
- ⇨ On the MCDU:
  -push the line key adjacent to the RETURN indication twice.
  Depressurize the hydraulic supply to the RAT ground test motor.
  ...

...

Close-up

...



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - ANTI-STALL DEVICE TEST

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

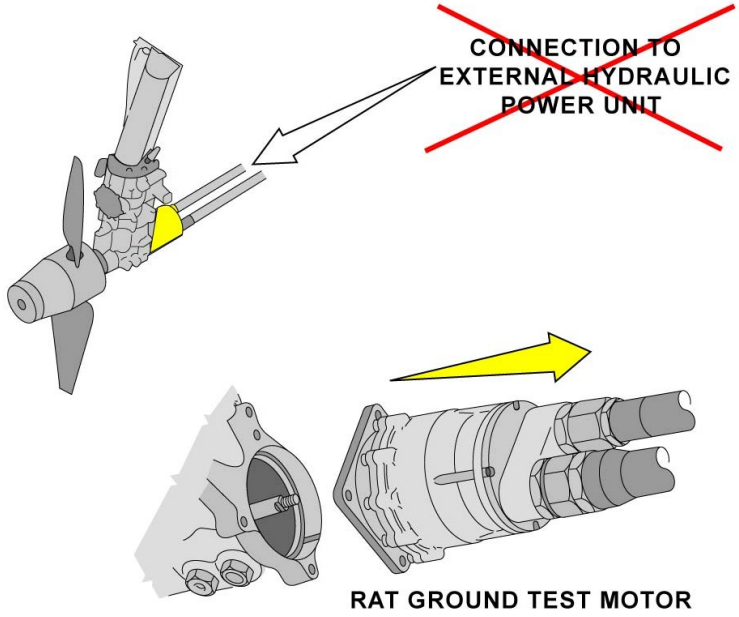
- Job set-up
- ...
- Procedure
- Operational Test of the Manual RAT Deployment
- ...
- Aircraft Maintenance Configuration
- Installation of the Ground Support Equipment
- Put the ACMS system in the operation condition
- Spin-Up and Governing Test with the ACMS
- Pump Test with the ACMS

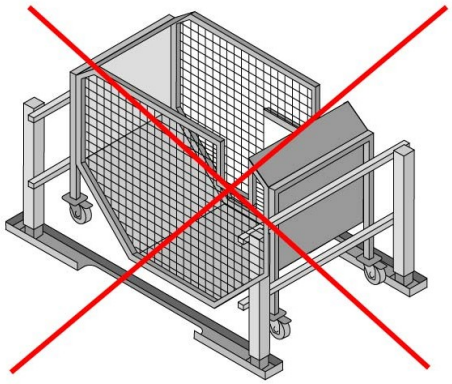
Anti-Stall Device Test with the ACMS

- On the hydraulic ground-power cart: ...
- On the MCDU: ...
- On the MLG control panel: ...
- On the MCDU: ...
- On the MCDU: ...

Depressurize the hydraulic supply to the RAT ground test motor.
Remove the RAT protective equipment.
Remove the RAT ground test motor.

- ...
- Close-up
- ...





OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - ANTI-STALL DEVICE TEST

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

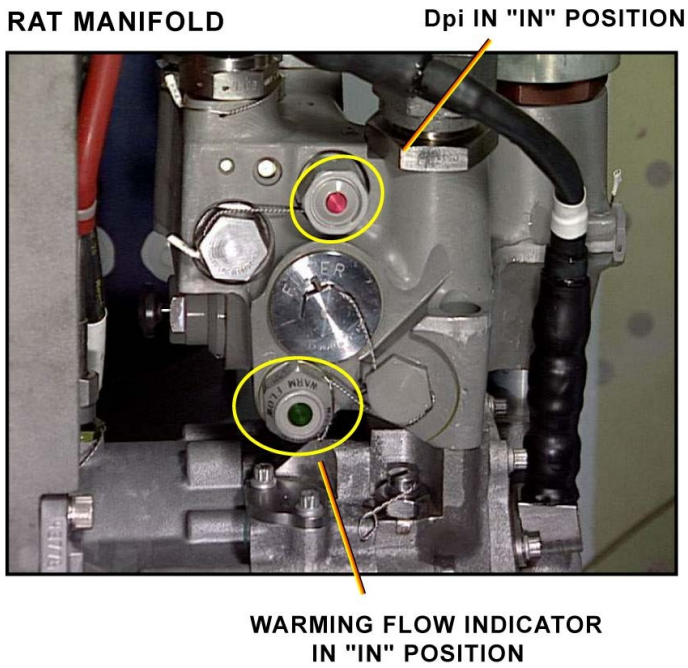
OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS (continued)

VISUAL INSPECTION AND CLOSE-UP

Check that the RAT warming flow indicator is in "OUT" position and the RAT Dpi is in "IN" position.
Open the LEAK MEASUREMENT VALVES and reset any tripped C/B.
The area can be closed after removing all tools and equipment used during this procedure.

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- ✓ Installation of the Ground Support Equipment
- ✓ Put the ACMS system in the operation condition
- ✓ Spin-Up and Governing Test with the ACMS
- ✓ Pump Test with the ACMS
- ✓ Anti-Stall Device Test with the ACMS
- Inspection
  - ⇨ Inspect the RAT and make sure that:
    -the RAT warming flow indicator is in "OUT" position,
    -the RAT differencial pressure-indicator is in "IN" position,
  - Check the oil level on the angle gearbox (the oil level is visible at the sight glass). If the oil level is not visible at the sight glass, add oil.
- Close-up
- ...



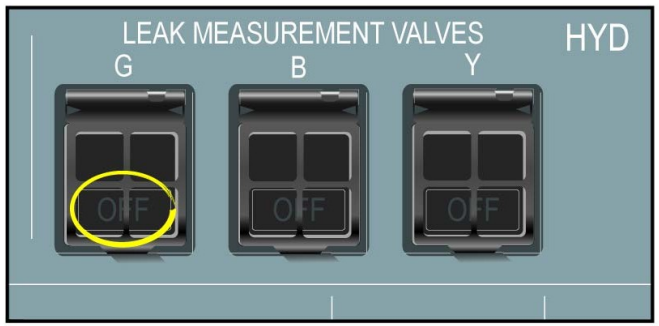
OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - VISUAL INSPECTION AND CLOSE-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- ✓ Installation of the Ground Support Equipment
- ✓ Put the ACMS system in the operation condition
- ✓ Spin-Up and Governing Test with the ACMS
- ✓ Pump Test with the ACMS
- ✓ Anti-Stall Device Test with the ACMS
- ✓ Inspection
- Close-up
- ...
- ⇨ On the HYD section of the maintenance panel 285VU, push the LEAK MEASUREMENT VALVES/Y and LEAK MEASUREMENT VALVE G pushbutton switches (the OFF legends of these pushbutton switches go off).
- ...

(285VU)



OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - VISUAL INSPECTION AND CLOSE-UP

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Operational Test of the RAT Manual Deployment / Inspection / Test with ACMS

- ✓ Job set-up
- ...
- ✓ Procedure
- ✓ Operational Test of the Manual RAT Deployment
- ...
- ✓ Aircraft Maintenance Configuration
- ✓ Installation of the Ground Support Equipment
- ✓ Put the ACMS system in the operation condition
- ✓ Spin-Up and Governing Test with the ACMS
- ✓ Pump Test with the ACMS
- ✓ Anti-Stall Device Test with the ACMS
- ✓ Inspection
- ...
- ✓ Close-up
- ...

TASK COMPLETED

OPERATIONAL TEST OF THE RAT MANUAL DEPLOYMENT / INSPECTION / TEST WITH ACMS - VISUAL INSPECTION AND CLOSE-UP

RAM AIR TURBINE MAN DEPLOYMENT SYS LINE MAINT (2)

OIL REPLENISHMENT OF THE RAT

This procedure helps you to do the RAT servicing.
Place safety barriers and warning notices at the RAT location. Extend the RAT, then trip, safety and tag the RAT STOW CTL C/B located in the avionics compartment to prevent retraction of the RAT.
Remove the oil filling plug and fill in with appropriate oil until it flows out. Fit a new seal onto the plug, then apply the correct torque. Check the oil level on the middle of the sight glass.
Reset RAT STOW CTL C/B. Clear the work area. Retract the RAT.

Oil Replenishment of the RAM Air Turbine

Job set-up

...

Extend the RAT.

...

Trip, safety and tag the RAT STOW CTL C/B (1JR).

Procedure

...

Fill the RAT gearboxes.

...

Install the new packing and the oil filling plug.

Make sure the oil level is above the middle of the sight glass.

...

Close-up

...

OIL REPLENISHMENT OF THE RAT

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Oil Replenishment of the RAM Air Turbine

Job set-up

...

Extend the RAT.

...

Trip, safety and tag the RAT STOW CTL C/B (1JR).

Procedure

...

Fill the RAT gearboxes.

...

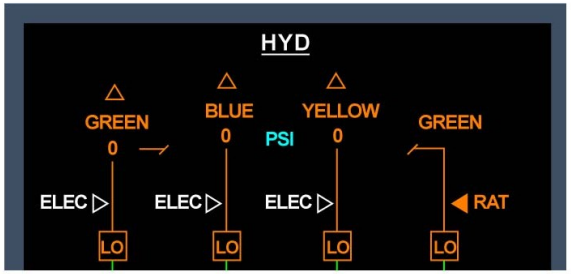
Install the new packing and the oil filling plug.

Make sure the oil level is above the middle of the sight glass.

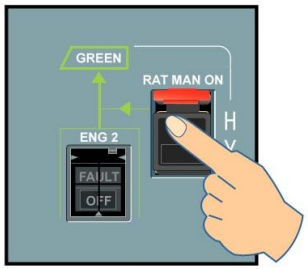
...

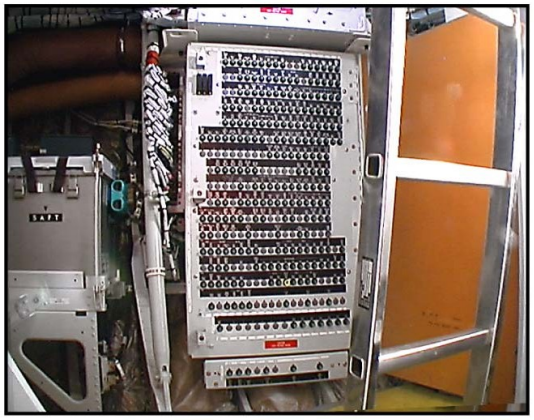
Close-up

...



HYDRAULIC PANEL (245VU)





TRIP THE C/B

EXTEND THE RAT

OIL REPLENISHMENT OF THE RAT

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Oil Replenishment of the RAM Air Turbine

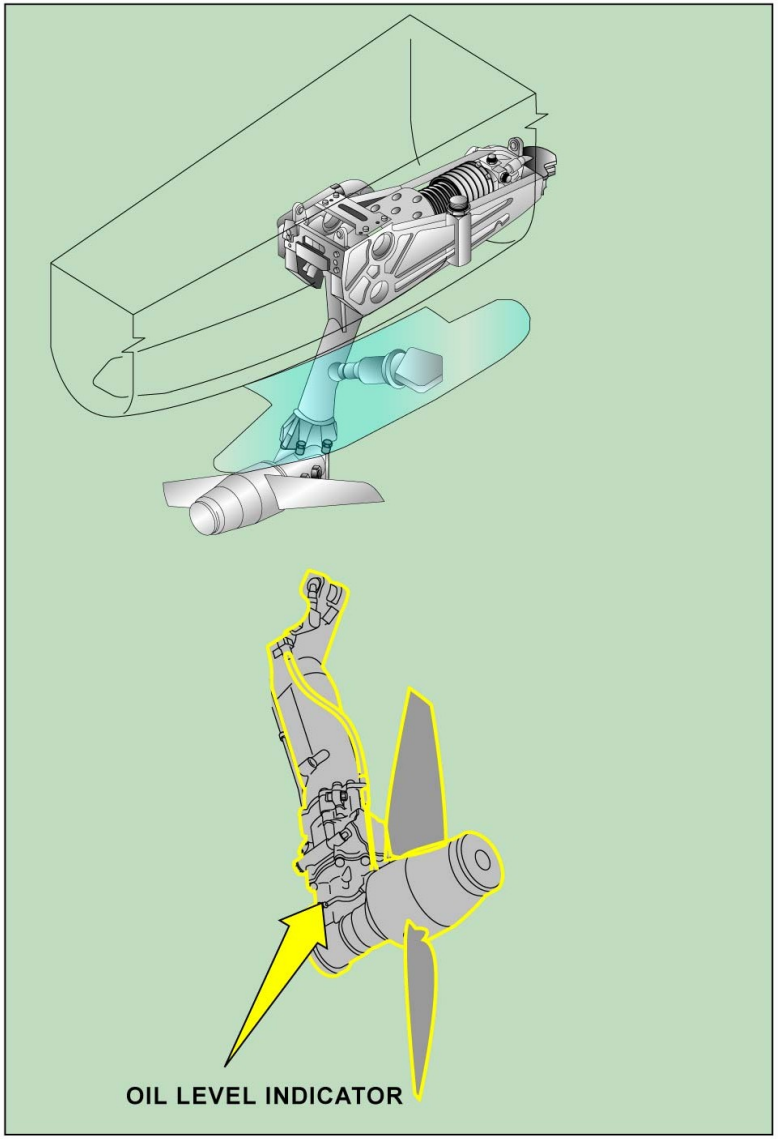
- ✓ Job set-up
- ...
- ✓ Extend the RAT.
- ...
- ✓ Trip, safety and tag the RAT STOW CTL C/B (1JR).

Procedure

- ...
- ✓ Fill the RAT gearboxes.
- ...
- ✓ Install the new packing and the oil filling plug.
- ⇨ Make sure the oil level is above the middle of the sight glass.
- ...

Close-up

...



OIL REPLENISHMENT OF THE RAT

G9409341 - GAUT0T0 - FM29Y2LINEMCE03

Oil Replenishment of the RAM Air Turbine

- ✓ Job set-up
- ...
- ✓ Extend the RAT.
- ...
- ✓ Trip, safety and tag the RAT STOW CTL C/B (1JR).
- ✓ Procedure
- ...
- ✓ Fill the RAT gearboxes.
- ...
- ✓ Install the new packing and the oil filling plug.
- ✓ Make sure the oil level is above the middle of the sight glass.
- ...
- ✓ Close-up
- ...

TASK COMPLETED

OIL REPLENISHMENT OF THE RAT

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AIRBUS

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